NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

BUDGET ESTIMATES

FISCAL YEAR 2006

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CONGRESSIONAL SUBMISSION

OCEANIC AND ATMOSPHERIC RESEARCH
OPERATIONS RESEARCH AND FACILITIES
FY 2006 OVERVIEW

SUMMARIZED FINANCIAL DATA
($ in thousands)

Operations Research and Facilities	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Climate Research	171,541	177,311	159,556	177,590	18,034
Weather and Air Quality Research	55,462	50,890	36,499	38,199	1,700
Ocean, Coastal, and Great Lakes Research	153,614	146,826	114,438	118,562	4,124
Information Technology, R&D, and Science Education	12,700	29,079	27,130	27,356	226
TOTAL	393,317	404,106	337,623	361,707	24,084
FTE	754	698	697	711	14

For FY 2006, NOAA requests a total of $361,707,000 for the Office of Oceanic and Atmospheric Research Operations, Research and Facilities (ORF), a net increase of $24,084,000.

FY 2006 Overview

The primary center for research and development within NOAA is the Office of Oceanic and Atmospheric Research (OAR), also referred to as NOAA Research. The major research themes are Climate Research; Weather and Air Quality Research; Ocean, Coastal and Great Lakes Research; and Information Technology, Research and Development (R&D), and Science Education. The goal of Climate Research is to understand complex climate systems to improve predictions. The goal of Weather and Air Quality Research is to understand atmospheric events to assist in saving lives and property worldwide. The goal of Ocean, Coastal and Great Lakes Research to develop better management tools through a better understanding of our ocean and Great Lakes habitats and resources. The goal of Information Technology, Research and Development, and Science Education is to accelerate the adoption of advanced computing, communications, and information technology throughout NOAA and to provide science education to help expand the pipeline of potential future scientists and researchers for industry, academia, and government.

This research is accomplished through a national network of 11 OAR laboratories and several other OAR and university-based research programs. The OAR budget activity is managed through 9 components - OAR Research Laboratories and Joint Institutes; Office of Global Programs; National Sea Grant

College Program; National Undersea Research Program; Office of Climate Observations and Services; Office of Ocean Exploration; Office of Weather & Air Quality; Arctic Research Office; and Information Technology R&D and Science Education. With this diverse research "tool kit," OAR provides national and international leadership on critical environmental issues and addresses environmental R&D needs of internal NOAA customers, states, industry, the Department of Commerce, and other Federal agencies.

OAR's Laboratories and Joint Institutes consist of 11 laboratories, all charged with the mission of securing a better scientific understanding of the Earth we all share. The research conducted at the laboratories is broken-up into three sub-activities; Climate Research, charged with the mission of monitoring the Earth's atmosphere for clues about long-term changes in the global climate; Weather and Air Quality Research, where researchers strive to provide the Nation with more accurate and timely warnings and forecasts of various high-impact weather and air events like storms, and air quality, particularly ozone and aerosols (particulate matter), all of which may disrupt economic productivity, impact human health or cause loss of life and property. The third sub-activity is Ocean, Coastal, & Great Lakes Research, where the research serves to increase our understanding of coastal and marine processes for the purpose of predicting the effects of climate change on ecosystems as well as environmental and ecosystem changes (e.g. invasive species).

NOAA Research Laboratories and Joint Institutes

Eleven OAR Research Laboratories administer and manage OAR programs, emphasizing theoretical and analytical studies, laboratory experiments, and field observations. The primary purpose of OAR's research is to improve NOAA services and to provide the basis for improved decision making by policymakes and the public. The OAR Laboratories collaborate closely with twelve university-based Joint Institutes and sponsor research through contracts and grants with other universities, state and Federal agencies, and private enterprises. The eleven Laboratories are:

Aeronomy Laboratory (AL) in Boulder, CO, conducts fundamental research on the chemical and physical processes of the earth's atmosphere, concentrating on the lower two layers known as the troposphere and stratosphere. Through laboratory study, modeling, and field research, AL scientists are advancing the scientific understanding of chemical and physical processes related to the ozone layer, the climate system, and air quality. Their aim is to improve our capability to observe, understand, predict, and protect the atmosphere. The AL's *Climate Research* findings provide a sound scientific basis for decisions made in industry and government related to ozone layer protection, air quality improvement, and understanding of climate change. AL plays leading roles in producing "state-of-the-science" assessment reports for use by national and international decision makers on all three of those topics. AL contributes toward an improved understanding of the depletion of the stratospheric ozone layer and the chemistry, radiation, and dynamics of climate. Efforts include determining the atmospheric lifetimes of greenhouse gases; assessing the "climate friendliness" of proposed replacements for ozone-damaging chlorofluorocarbons (CFCs); advancing understanding of tropospheric "greenhouse" ozone, aerosols, clouds, and radiation; understanding the relationships between tropical dynamics and climate variability; developing and applying new measurement techniques that can quantify the chemical and radiative roles of aerosols in climate; helping to assess the role of aviation in climate and ozone-layer depletion; characterizing the chemical and dynamical factors that affect stratospheric ozone depletion, both at the poles and at more-populated middle altitudes; and gaining a better predictive understanding of the role of natural and human influences on ozone-layer variations during the coming vulnerable decade of highest ozone depletion.

AL's weather and air quality research is focused on regional tropospheric chemistry, with an emphasis on air quality. Research results are used by NOAA to develop and improve air quality forecast and assessment models and provide valued information to decision makers. Efforts include describing ozone formation on regional scales and in rural areas; determining the impact of natural emissions of hydrocarbons on ozone formation in particular regions of the U.S; understanding the chemistry and dynamics of plumes from power-generating plants and their influence on regional air quality; developing airborne measurement techniques that can better characterize the chemistry and dynamics of the lower atmosphere, including the chemical composition of particulate matter; and participating in air quality research-coordinating efforts, such as the Air Quality Subcommittee of the Committee on Environment and Natural Resources (U.S.) and the North American Research Strategy for Tropospheric Ozone (U.S., Canada, and Mexico).

Air Resources Laboratory (ARL) is headquartered in Silver Spring, MD, with divisions in Oak Ridge, TN; Research Triangle Park, NC; Idaho Falls, ID; Las Vegas, NV; and Boulder, CO. ARL carries out research on processes that affect the quality of the atmosphere. These processes include the transport, transformation, and removal of trace substances through both wet and dry deposition and the exchange between the atmosphere and such biological and non-biological surfaces as field crops and structures. ARL's field and laboratory studies lead to the development of air quality simulation models. The Laboratory provides scientific advice to NOAA and other government agencies to assist with emergency preparedness for such environmental problems as nuclear mishaps, volcanic eruptions, and homeland security issues.

ARL climate research studies the biogeochemical cycles of trace substances and their effects and interactions with the radiative regime at the earth's surface. ARL operates research-grade measurement stations at which the exchange of carbon dioxide and water vapor between the air and the biosphere is directly measured, and other stations at which the infrared and ultraviolet as well as visible components of the surface radiation balance are monitored. ARL focuses not only on the development of deterministic models to describe the relevant processes, but also on the often-dominant role of random variability that cannot be explained by current understanding. Research in all of these areas involves physical and numerical studies, leading to the development of specialized models. The laboratory provides scientific advice to elements of NOAA and other government agencies on climate issues, and on the role of natural variability.

ARL weather and air quality research conducts physical and numerical studies of the processes affecting the quality of the atmosphere, primarily related to transport, transformation, and removal of trace substances, and uses these results to develop improved air quality forecast and assessment models. Research and develop efforts include physical and numerical studies, leading to the development of air quality simulation models for regulatory and policy purposes, and increasingly for forecasting; improvement of understanding of processes that influence air quality, such as complex terrain, local meteorological conditions, and long-range transport; the Real-time Environmental Applications and Demonstration system (READY) as a mechanism for external users to gain access to ARL's suite of air quality forecast products; and providing relevant scientific advice to elements of NOAA and other government agencies, including those associated with homeland security.

Atlantic Oceanographic and Meteorological Laboratory (AOML) in Miami, FL, conducts research in oceanography, tropical meteorology, atmospheric and oceanic chemistry, and acoustics. AOML seeks to understand the physical and biological characteristics and processes of the ocean and the

atmosphere, both separately and as a coupled system. AOML scientists study hurricanes, ocean current and temperature structures, ocean/atmosphere chemical exchanges, coral reefs, and the coastal ocean. They do this by using research ships and aircraft, satellite remote sensing techniques, numerical and statistical models, radar, acoustics, and drifting buoys.

The principal focus of AOML is to provide knowledge that may ultimately lead to improved prediction and forecasting of tropical cyclones and severe weather, better use and management of marine resources, better understanding of the factors affecting both climate and environmental quality, and improved ocean and weather services for the nation.

AOML climate research provides and interprets oceanographic data and conducts research relevant to decadal climate change and coastal ecosystems. This research includes the dynamics of the ocean, its interaction with the atmosphere, and its role in climate and climate change. On a global scale, AOML scientists, in conjunction with the PMEL and CMDL are studying the exchange of CO2 between the ocean and the atmosphere and its effects on global warming and climate change. This research is conducted through numerous open ocean cruises aboard NOAA's research vessel, the NOAA Ship *Ronald H. Brown.* AOML hosts NOAA's Global Ocean Observing System Center (GOOS Center), which uses expendable probes and other equipment to provide ocean surface and sub-surface data to NOAA's National Centers for Environmental Prediction (NCEP) in support of seasonal to interannual climate forecasts, as well as data for decadal-scale climate research.

AOML weather and air quality research is NOAA's primary component for research on hurricanes. Their aims are to improve the understanding and prediction of hurricane motion and intensity change through directed research and the transfer of research results to the operational hurricane forecast components of NOAA. Research and transition efforts include:

- The annual hurricane field program, supported by the NOAA Aircraft Operation's Center research/reconnaissance aircraft
- Analysis of data from field programs
- Theoretical and numerical modeling studies of hurricanes
- Prepare storm surge atlases and wind field diagrams
- Study interannual and decadal hurricane trends
- Critical assistance to the NWS Tropical Prediction Center's forecast improvement.
- Active participation in and support of the Joint Hurricane Testbed.

AOML ocean, coastal, and great lakes research scientists gather, analyze, and report coastal ocean data on land-based sources of pollution and their potential environmental impacts to the South Florida coastal environment. Scientists work in cooperation with other NOAA Line Offices, other federal, state, and local authorities, including the EPA and U.S. Army Corps of Engineers, to maximize research knowledge for use in economically and environmentally important projects in the coastal ocean such as the South Florida Ecosystem Restoration Program. AOML conducts research to improve the understanding of coral reef ecosystems through monitoring and making predictions based on the data. The Coral Reef Watch Program seeks to accomplish NOAA's goal of ecosystem forecasting and management by improving understanding of the reef ecosystem. Initiation of comprehensive long-term *in situ* coral-reef monitoring stations is intended to provide information essential for sound management decisions, and long-term planning. AOML

also generates oceanographic data and conducts research relevant to decadal climate change and coastal ecosystems. This research includes ocean-atmosphere interactions, its role in climate and climate change. With a diverse scientific staff of physical, chemical, biological, and geological oceanographers, AOML is able to use multi-disciplinary approaches to solve NOAA's management activities.

Climate Diagnostics Center (CDC) in Boulder, CO, seeks to identify the nature and causes of climate variations on time scales ranging from a month to centuries so as to be able to accurately predict them. CDC does this through a coordinated program of diagnostic and modeling studies. CDC develops national capabilities to describe, interpret, and predict climate variations on time scales ranging from a few weeks to centuries. CDC's specific expertise is the development and application of state-of-the-art diagnostic techniques to identify the causes and potential predictability of important climate phenomena such as droughts, floods, El Niño-Southern Oscillation, and decadal-to-centennial climate variations. CDC also performs extensive intercomparisons of observational and climate model data, an activity vital to improving models used for climate research and forecasts.

CDC climate research is organized around three principal themes: 1) Intraseasonal to Interannual Climate Research; 2) Decadal to Centennial Climate Research; and 3) Experimental Climate Services. The first theme extends down to sub-seasonal time scales in order to address emerging national priorities on identifying the connections between climate and extreme weather events. The third theme was developed to support future requirements for NOAA's Climate Services. Research in this latter component focuses on increasing understanding of the climate-society interface, and particularly on how interactions between scientists and decision-makers can accelerate development of more useful climate products, and thereby improve the value of the climate information that NOAA provides to address a broad range of social, economic, and environmental issues.

Climate Monitoring & Diagnostics Laboratory (CMDL), in Boulder, CO, with baseline observatories located in Mauna Loa, HI; Barrow, AK; Cape Matatula, American Samoa; and South Pole, Antarctica. CMDL conducts research on atmospheric constituents capable of forcing climate change by modifying the radiative and other qualities of the atmosphere. CMDL studies greenhouse gases and aerosols, as well as the causes of the depletion of the global ozone layer. The four CMDL baseline observatories provide long-term continuous records of the chemical state of the atmosphere.

CMDL climate research conducts research related to atmospheric constituents that are capable of forcing change in the climate of the Earth or that may deplete the ozone layer. CMDL monitors greenhouse gases, aerosols, ozone, ozone-depleting gases and solar and terrestrial radiation at global sites including four Baseline Observatories. CMDL is comprised of five groups each tackling different, yet related, aspects of the climate change issue:

- The *Aerosol and Radiation Group* studies the behavior of atmospheric aerosols and radiation. The goals of this regional-scale monitoring program are to characterize means, variability, and trends of climate-forcing properties of different types of aerosols, and to understand the factors that control these properties.
- The *Carbon Cycle Greenhouse Gases Group* makes flask sample measurements from land and sea-surface sites and aircraft and continuous measurements from baseline observatories and tall towers. This group maintains compressed air standard reference gases for CO2, CH4, and CO.
- The *Ozone and Water Vapor Group* conducts research on the nature and causes of the depletion of the stratospheric ozone layer and the role of stratospheric and tropospheric ozone and water vapor in forcing climate change and in modifying the chemical cleansing capacity of the atmosphere.

- The mission of the *Halocarbons and other Atmospheric Trace Species (HATS) Group* is to quantify the distribution and magnitude of the sources and sinks for various greenhouse gases important to ozone-depletion. HATS also conduct measurements at sea, determining both the air and sea concentrations of halogen gases, at the surface of the global oceans.

The *Observatory Operations Group* maintains the CMDL baseline observatories. CMDL's four internationally recognized baseline observatories are located in Mauna Loa, HI; Barrow, AK; Cape Matatula, AS, and South Pole, Antarctica. In April 2002 a new station was established at Trinidad Head, California to monitor gases and aerosols flowing onto the west coast of the United States, some of which originate in Asia.

CMDL weather and air quality research conducts research to better understand the distribution and changes in the distribution of ozone near the surface and in the lower troposphere. Research results are used by NOAA to develop and improve air quality forecast and assessment models and provide valued information to decision makers. Of particular interest is:

- The role of human produced ozone precursors in elevating ozone concentrations in the remote atmosphere.
- Observations from a network of 8 long-term surface measurement sites observe ozone amounts with high time resolution. These sites are located to represent broad geographical regions.
- Determination of the importance of the human impact on lower tropospheric ozone and the possible consequences of changes on air quality and climate.

Environmental Technology Laboratory (ETL) in Boulder, CO, develops and uses innovative remote sensing systems to observe and understand atmospheric and oceanic processes in order to improve weather and climate predictions. The Laboratory engages in field and laboratory studies to apply the basic physics of the interaction of electromagnetic and acoustic waves in air and water to be able to more effectively monitor the behavior of the oceans and atmosphere, which is critical to improved predictions. In addition, ETL develops such technologies to the point where they can be transitioned into forecast operations.

Climate research at ETL, researchers collaborate with colleagues around the world to create advanced remote sensors to better understand our complex climate. Remote sensing allows researchers to observe the temporally and spatially varying properties of climate. It is critical to our understanding of the global water and energy budget, the interactions between the oceans and atmosphere that modulate climate, and to the collection of climate data sets. Passive and active ground, airborne, and satellite-based remote sensors allow researchers to collect the long-term, high-resolution data sets necessary for improved climate modeling and prediction. Climatic research themes at ETL which illustrate the integrated research process include:

- *Global Water and Energy Budget*. Processes that exchange water and energy between the atmosphere and oceans govern the global climate. Researchers rely on satellite and ground-based sensors to observe these processes on the global scale and to provide data for models.
- *Air-Sea-Ice Interaction*. Air-ice-sea interaction studies close a critical gap in our understanding of the climate. These complex processes determine the exchange of energy, water, and gases between the atmosphere and oceans, modulating our climate and driving weather systems.
- *Climate Monitoring and Data Sets*. Long-term, high-resolution datasets required for climate modeling and predictions can only be acquired by space-based or automated ground-based systems. Researchers at ETL work with satellite data sets to remove instrument biases and retrieve

climate properties such as water vapor, cloud radiance, ocean surface winds, and sea surface temperature. Ground-based sensors developed at ETL, such as the Millimeter Cloud Radar and DABUL Lidar, are being used in remote climate monitoring sites and field programs for validation and development of satellite based instruments. Retrieval techniques developed at ETL allow for the development of cloud properties and water vapor data sets necessary for regional and global climate modeling and forecasting.

Weather and air quality research at ETL encompasses all aspects of systems development. ETL conducts research and develops observational technologies that lend improvements to NWS weather forecast capabilities, advanced severe weather warnings, hazard detection, air quality assessment, and pollution mapping. ETL takes a comprehensive approach to meet environmental measurement challenges through theoretical and modeling studies, the design, development, and testing of remote sensing instruments and techniques, the conceptualization and execution of field programs, and the acquisition and analysis of high-resolution environmental datasets.

Ocean, coastal, and great lakes research at ETL, researchers collaborate with NOAA and external colleagues around the world to create advanced remote sensing technologies to address environmental challenges. Remote sensors use light, radio, and sound waves to observe distant ocean properties and processes. Ocean remote sensors can provide information vital to improved coastal ecosystem forecasting (e.g. Harmful Algal Blooms) and fisheries management. Ocean research themes at ETL include: Ocean Sensor Development, Coastal Forecasting, and Fisheries Management.

Forecast Systems Laboratory (FSL) in Boulder, CO, conducts research and develops and transfers new technologies and scientific advancements in atmospheric and oceanic research to the operational elements of NOAA, like the NWS, and to other domestic and foreign organizations. This involves: (1) exploratory system development to improve research, operations, and information management; (2) application of research results toward improved data analyses, forecast systems, and methods for understanding atmospheric processes; (3) system validation utilizing real-time and archived data to test and evaluate new diagnostic and forecast techniques; and (4) transfer of new techniques and systems to operational use through direct interaction with the users.

Climate research at FSL operates and maintains the Ground-Based Global Position Satellite (GPS) Water Vapor Demonstration Network, currently consisting of 60 sites located in the contiguous 48 states and Alaska. This observing system measures the integrated (total column) quantity of precipitable water vapor above a fixed site in near real time. Water vapor is one of the most significant constituents of the atmosphere since it is the means by which moisture and latent heat are transported to cause "weather." Water vapor is also a greenhouse gas that plays a critical role in the global climate system. This role is not restricted to absorbing and radiating energy from the sun, but includes the effect it has on the formation of clouds and aerosols and the chemistry of the lower atmosphere. Despite its importance to atmospheric processes over a wide range of spatial and temporal scales, water vapor is one of the least understood and poorly described components of the Earth's atmosphere.

The mission of *weather and air quality research* at FSL is to anticipate the science and technology that will be needed by the Nation's operational atmospheric, oceanic, and hydrological forecasting services in the next five to ten years. After researching and developing new observing and forecasting systems, FSL transfers those technologies to operational users such as the NWS, other government agencies (e.g. U.S. Air Force and the Federal Aviation Administration), the commercial and general aviation communities, foreign weather forecasting services, and other private interests.

Most recently, the NOAA Profiler Network has collaborated with NWS/NDBC, NOS, and NOAA Joint Institutes to develop an all-weather water vapor sensing system using GPS, which provides remote, real-time measurement of water vapor fields over the U.S. in a partnership with the U.S. Coast Guard, Department of Transportation, and National Science Foundation. FSL's essential functions are:

- *Exploratory Systems Development.* The rapid pace of technological change requires continuous, exploratory systems development by FSL. In cooperation with operations specialists, FSL first developed and now continuously upgrades forecasting software, called AWIPS, used by the NWS. It is also investigating the use of the Linux operating system, high speed networks, and PC technology to make forecasting even more efficient and effective.
- *Research Applications.* Research conducted by FSL seeks to capitalize on an improved understanding of the atmosphere-land-ocean environment to develop better techniques for observations, data assimilation, and operational forecast models.
- *System Validation.* Before new technologies can be transferred to operational services, FSL uses real-time and archived data to test and evaluate new diagnostic and forecasting techniques and new hardware and software technologies.
- *Technology Transfer*. After the quality assurance process, FSL works directly with users to transfer technology improvements to operational use, as well as to users of environmental information and prediction systems.

Geophysical Fluid Dynamics Laboratory (GFDL) in Princeton, NJ, conducts leading-edge research on many topics of great practical value, including weather and hurricane forecasts, El Nino prediction, stratospheric ozone depletion, and global warming. GFDL's goal is to understand and predict Earth's climate and weather, including the impact of human activities on climate.

GFDL's *Climate Research* mission is the production of timely and reliable knowledge on natural climate variability and anthropogenic climate changes and in the development of the required earth system models, and to work cooperatively in NOAA to advance its expert assessments of changes in national and global climate. To achieve its mission GFDL conducts comprehensive long lead-time climate research fundamental to expanding the scientific understanding of the physical and chemical processes that govern the behavior of the atmosphere and oceans as complex fluid systems. This research leads to state-of-art earth system models systematically utilized to provide a suite of climate products for decision support by policy makers. To enable the research and climate simulations GFDL supports a very large, scalable computer system that provides critical computing, storage, and analysis capabilities, as well as model development and infrastructure support. This computing program allows NOAA to leverage the world-class research staff at GFDL to advance the Nation's climate program working together with the inter-agency and academic research community.

Weather and Air Quality Research at GFDL is engaged in comprehensive long lead-time research fundamental to NOAA's mission. The goal of the Laboratory's atmospheric research is to expand the scientific understanding of the physical processes that govern the behavior of the atmosphere as a complex fluid system. This system can then be modeled mathematically and their phenomenology can be studied by computer simulation methods. The need for short-term warning and forecast product covers a broad spectrum of environmental events, which have lifetimes ranging from several minutes to several weeks. Efforts at GFDL are centered on the development of comprehensive numerical Earth System models and the frameworks in which the models are embedded. These numerical models are used in the prediction of "short-term" atmospheric phenomena such as hurricanes and coastal storms,

but may also be used to study longer-term events such as the evolution of storm tracks over the oceans. The goal of the Laboratory's atmospheric research is to expand the scientific understanding of the physical processes that govern the behavior of the atmosphere as a complex fluid system, model this system mathematically and study its phenomenology, and to develop and transition to NOAA operations of numerical models used in the prediction of short-term atmospheric phenomena, including tornadoes, hurricanes, and coastal storms.

Great Lakes Environmental Research Laboratory (GLERL) is located in Ann Arbor, MI, and has a field facility in Muskegon, MI. GLERL conducts integrated, interdisciplinary environmental research in support of resource management and environmental services in coastal and estuarine waters, with a primary emphasis on the Great Lakes. The laboratory performs field, analytical, and laboratory investigations to improve understanding and prediction of biological and physical processes in estuaries and coastal areas and their interdependencies with the atmosphere and sediments. GLERL emphasizes a systems approach to problem-oriented research to develop environmental service tools.

National Severe Storms Laboratory (NSSL) in Norman, OK, conducts research to improve the accuracy and timeliness of forecasts and warnings of such hazardous weather events as blizzards, ice storms, flash floods, tornadoes, and lightning. NSSL does this through a balanced program of research to: (1) better understand weather processes, (2) improve forecast and warning techniques, (3) develop operational applications, and (4) transfer understanding, techniques, technologies, and applications to the NWS and other agencies.

Weather and Air Quality research at NSSL conducts research to improve accurate and timely forecasts and warnings of hazardous weather events such as blizzards, ice storms, flash floods, hail, tornadoes, and lightning. NSSL accomplishes this goal through a balanced program of research to:

- Advance the understanding of weather processes;
- Improve forecasting and warning techniques;
- Development of operational applications;
- Transfer of understanding, techniques, and applications to the NWS and other agencies;
- Development of the NEXRAD Doppler weather radar, the cornerstone Doppler radar network now operated by NWS offices across the United States, and the development of new radar technologies (e.g., dual-polarization and phased array radar); and
- Conduct field programs that use mobile, *in situ*, and remote observational capabilities to collect data that support theoretical research.

Pacific Marine Environmental Laboratory (PMEL) in Seattle, WA, carries out interdisciplinary scientific investigations in oceanography, marine meteorology, and related subjects. PMEL focuses on coastal and open-ocean observations and modeling to improve: (1) our understanding of the physical, biological, and geochemical processes operating in the world oceans and (2) environmental forecasting capabilities and other supporting services for marine commerce and fisheries. PMEL also supports an undersea observation and research program (VENTS) in Newport, OR.

Current *climate research* PMEL programs focus on coastal and open ocean observations in support of prediction of the ocean environment on time scales from days to decades. Studies are conducted to improve our understanding of the complex physical and geochemical processes operating in the world oceans, to define the forcing functions and the processes driving ocean circulation and the global climate system, and to improve environmental forecasting

capabilities and other supporting services for marine commerce and fisheries. The internationally known laboratory leads the way in El Nino research that has improved climate forecasts leading to reduced fatalities and property losses.

The focus of PMEL's activity in regards to *weather and air quality* is in support of the NWS tsunami warning centers by conducting research and development on the improvement of tsunami forecasting. Research results are used by NOAA to develop and transfer to NWS improved forecast abilities and modeling while providing valued information to decision makers. *Ocean, Coastal, and Great Lakes Research* at PMEL conducts several ocean research programs;

- Fisheries Oceanography Coordinated Investigations (FOCI) is a collaborative research effort by scientists at PMEL and the Alaska Fisheries Science Center to improve the prediction of valuable fish (e.g. Pollock) and shellfish stocks in the Gulf of Alaska and the Bering Sea for the AK Regional Fisheries Councils. Forecasting these changes provides North Pacific fisheries managers with the best available information necessary for allocating fish landings by commercial fishermen.
- The Vents Program, established in 1984, conducts research on the oceanic impacts and consequences of submarine volcanoes and hydrothermal venting. The program focuses on understanding the chemical and thermal effects of venting along the northeast Pacific Ocean seafloor spreading centers, which provides the foundation for prediction of the global-scale impact of seafloor hydrothermal systems on the ocean.
- Continued support of the Tsunami Project, recently transferred to NWS for operational oversight. The project seeks to mitigate tsunami hazards in Hawaii, California, Oregon, Washington, and Alaska through improved tsunami warnings using state-of-the-art instrument systems developed by the Laboratory's Engineering Development Division. The goal of this project is to reduce fatalities, damage, and losses caused by these natural hazards.

Joint Institutes - OAR has developed "joint institute" research partnerships with academic and scientific institutions dedicated to oceanic and atmospheric research. The Joint and Cooperative Institutes, also referred to as "the University Programs" are formal, long-term collaborations established under a MOU/MOA with NOAA. By design, most of the Institutes are co-located with one or more NOAA facilities to promote scientific interchange and technology transfer. The primary purpose of each Institute is to bring together the diverse resources of a research university or institution, one or more OAR laboratories, and other branches of NOAA to develop and maintain a center of excellence in research.

The OAR Joint Institutes include:

CIASTA	Cooperative Institute for Atmospheric Sciences and Terrestrials Applications - Desert Research Institute of the University and Community College System of Nevada, Las Vegas and Reno, NV
CICAR	Cooperative Institute for Climate Applications and Research, Columbia, NY
CICOR	Cooperative Institute for Climate and Ocean Research – Woods Hole Oceanographic Institution, Woods Hole, MA
CIFAR	Cooperative Institute for Arctic Research - U. of Alaska, Fairbanks, AK
CILER	Cooperative Institute for Limnology and Ecosystems Research - U. of Michigan, Ann Arbor, MI
CIMAS	Cooperative Institute for Marine and Atmospheric Studies - U. of Miami, Miami, FL
CIMMS	Cooperative Institute for Mesoscale Meteorological Studies, U. of Oklahoma, Norman, OK
CIRA	Cooperative Institute for Research in the Atmosphere - Colorado State U., Fort Collins, CO
CIRES	Cooperative Institute for Research in Environmental Sciences - U. of Colorado, Boulder, CO
JIMAR	Joint Institute for Marine and Atmospheric Research - U. of Hawaii, Honolulu, HI
JIMO	Joint Institute for Marine Observations - Scripps Institution of Oceanography, U. of California-San Diego and La Jolla, CA
JISAO	Joint Institute for the Study of the Atmosphere and Oceans - U. of Washington, Seattle, WA
AOSRP	Atmospheric and Oceanic Sciences Research Program at Princeton University; Princeton, New Jersey

The Office of Global Programs (OGP) in Silver Spring, MD, leads NOAA's Climate and Global Change Program. OGP sponsors research aimed at understanding climate variability and predictability. This research contributes to improved predictions and assessments of climate variability over timescales spanning seasons, years, decades, and beyond. In addition, OGP research and assessments are designed to provide the scientific information needed for major environmental decisions and focus on the climate-human interaction as well as on developing the institutional, scientific and technical capacity to advance climate science.

National Sea Grant College Program - Congress established the National Sea Grant College Program in 1966 to enhance the development, use, and conservation of the Nation's marine and Great Lakes resources. The legislation establishes a network of Sea Grant Colleges to conduct education, training, and research in all fields of marine study. It also directs that grants and contracts may be awarded to: “any individual; any public or private corporation, partnership, or other association or entity (including any Sea Grant College, Sea Grant Institute or other institution) or any State, political subdivision of a State, or agency or officer thereof" [PL 105-160]. The National Sea Grant College Program Office is located in Silver Spring, MD. Currently there are 30 State Sea Grant programs located in virtually every U.S. coastal and Great Lake State. Most Sea Grant Programs include multiple campuses of different universities across the state.

National Undersea Research Program (NURP) - Scientists funded by the National Undersea Research Program (NURP) conduct wide-ranging research investigations in such areas as the causes behind depletion of fisheries, the impacts of commercial fishing activity on critical habitats, the effects of climate change on the health of coral reefs, and undersea volcanism and its role in coastal hazards. The program also supports research at a long-term ecosystem

observatory off the coast of New Jersey to provide a continuous stream of physical and biological data necessary to model coastal ecosystems and predict how they will respond to such major events as storms, oil spills, and the presence of excess nutrients. This program also conducts mandated studies of underwater diving techniques and equipment suitable for protection of human safety and improvement in diver performance. The program is comprised of a headquarters office in Silver Spring, MD, and six regional National Undersea Research Centers focused on: the Caribbean, Hawaii and the Pacific, Middle Atlantic, North Atlantic and Great Lakes, Southeast and Gulf of Mexico, and West Coast and Polar Regions.

Climate Observations and Services – Climate Observations and Services research activity represents a NOAA multi-line organization activity managed as an integrated program that is central to describing, understanding, and predicting the earth's climate system. The observational element of NOAA's climate services is to build and sustain the global climate observing system. This system is needed to satisfy the long-term requirements of the operational forecast centers, international research programs, and major scientific assessments. NOAA's climate observation program is built on the recognition that national and international partnerships are essential to success. A global observing system by definition crosses international boundaries and the potential exists for benefits to be shared by many nations. Climate Observations and Services also provides an operational interface between users and providers of reliable climate products and services, and a broader range of customer services for NOAA climate products, including new local forecast products.

Ocean Exploration – Nearly 95% of the ocean is unknown and unexplored and NOAA is the only Federal Agency with a dedicated Ocean Exploration Program. This program supports exploration of the unknown ocean as well as improved marine science and education. The Ocean Exploration program funds research and education activities through standard peer-review processes. There are four key objectives to the program:

- Explore unknown and poorly known areas of the ocean;
- Map the physical, geological, biological, chemical, and archaeological aspects of the oceans;
- Develop new sensors and systems for ocean exploration to regain U.S. leadership in marine technology; and

Connect in innovative ways to stakeholders to improve the literacy of learners of all ages with respect to ocean issues.

Office of Weather & Air Quality - The goal of Weather and Air Quality Research programs is to: (1) provide the Nation with more accurate and timely warnings and forecasts of: (a) weather events, particularly high-impact weather events, which disrupt economic productivity and cause loss of life and property, (b) air quality, particularly ozone and aerosol (particulate matter) that impact human health, cause crop damage, and affect private sector operational planning for power generation; and (c) solar disturbances and their terrestrial effects, including hazards to satellites and disruptions of communications, navigation, and utility systems and (2) provide the scientific basis for developing public policy tools for air quality by: (a) improving the understanding and characterization of air quality (i.e., aerosol, ozone, VOC, NOx, and SOx); (b) improving air quality sensor technology to structure the monitoring network; and (c) developing and prototyping air quality models to forecast air quality and to perform diagnostic analysis of air quality episodes.

Arctic Research Office (ARO) - The Arctic Research Office serves as the focal point for NOAA's research activities in the Arctic, Bering Sea, North Pacific, and North Atlantic regions. The Office manages the Arctic Research Initiative and supports both internal NOAA and extramural research. It also undertakes coordination and outreach activities to support scientific research. It represents NOAA on the Interagency Arctic Research Policy Committee,

leads U.S. involvement in the international Arctic Monitoring and Assessment Program, and provides a point of contact between NOAA and the Cooperative Institute for Arctic Research and the International Arctic Research Center, both at the University of Alaska Fairbanks.

Information Technology R&D and Science Education:
High Performance Computing and Communications: The Office of High Performance Computing and Communications (HPCC) supports a number of objectives in NOAA's Strategic Plan, primarily through support of IT research targeted at improving NOAA's mission and services and science education to improve global understanding of science with emphasis on the environment. The purpose of the HPCC program is to make major improvements in the Nation's ability to forecast the weather and climate and to disseminate environmental information. At the same time the program is aimed at stimulating modernization of NOAA's computationally intensive services through the use of evolving high performance computing and high-speed networking technologies. Through this program, NOAA participates as a "mission" agency in the Interagency Working Group on Information Technology Research and Development. Improvements in the accuracy and timeliness of NOAA's short-term weather warnings, seasonal forecasts, and regional and global climate predictions are heavily dependent on major advances in high-end computing power, advanced information technology, and the widespread availability of environmental data and information. Timely and responsive dissemination of NOAA's services and information requires full use of modern network and communications technologies.

Educational Partnership Program with Minority Serving Institution (EPP/MSI): The EPP/MSI program supports NOAA's Environmental Literacy, Outreach and Education crosscutting priority in NOAA's Strategic Plan. In support of this priority, NOAA has made a commitment to expand and strengthen its partnerships with Minority Serving Institutions. The Educational Partnership Program's mission is to increase education and training opportunities for individuals attending MSIs in NOAA-related professions. Their goal is to encourage students to pursue applied research and education in atmospheric, oceanic, and environmental sciences and remote sensing programs. NOAA's EPP/MSI consists of four programmatic components, they are:

- Cooperative Science Centers;
- Environmental Entrepreneurship Program;
- Graduate Sciences Program; and,
- Undergraduate Scholarship Program.

Support for the NOAA Strategic Plan
OAR's activities support three Mission Goals in the NOAA Strategic Plan: Protect, Restore, and Manage the Use of Ocean and Coastal Resources Through an Ecosystem Approach to Management; Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond, and Serve Society's Needs for Weather and Water Information. Activities also support NOAA's Mission Support Goal to Provide Critical Support for NOAA's Mission.

Results from OMB Program Assessment Rating Tool for the NOAA Climate Program
The NOAA Climate Program was rated "Moderately Effective" as a result of the Office of Management and Budget **Program Assessment Rating Tool (PART)** for FY06. The assessment found that the program is relatively strong and has undertaken steps to improve program management and focus on results. Additional findings included: (1) NOAA Climate coordinates with other federal agencies through the Climate Change Science Program; (2) Deficiencies in the management of NOAA's laboratory activities as identified by the NOAA Research Review Team; (3) Need to better integrate performance into budget decisions; and (4) Program has appropriate long-term goals and annual measures which demonstrate progress. In response to these findings NOAA is evaluating its options for consolidating the laboratories and other management changes recommended by the Review Team, as well as implementing a database for tracking performance and linking it to the budget.

Significant Adjustments-to-Base (ATBs): NOAA requests an increase of $3,961,000 and 0 FTE to fund adjustments to base for NOAA Research activities. The increase will fund the estimated FY 2006 Federal pay raise of 2.3 percent and annualize the FY 2005 pay raise of 3.5 percent. The increase will also provide inflationary increases for non-labor activities, including service contracts, utilities, field office lease payments, and rent charges from the General Service Administration. Finally, it will restore rescissions taken in the FY 2005 Appropriation.

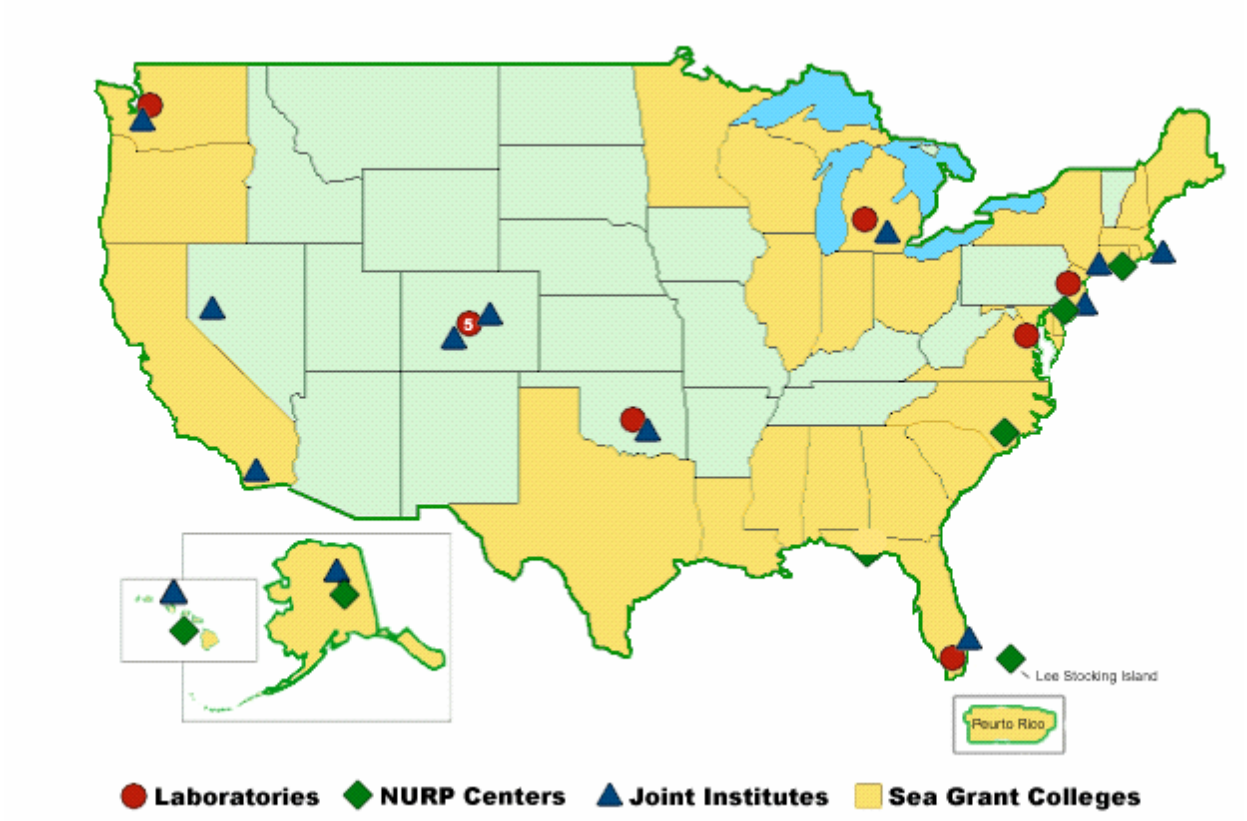
Included in the above amount is $1,520,000 for amortized construction costs and net rent cost increases associated with the new National Weather Center on the South Campus of the University of Oklahoma. Based upon the February 2006 Beneficial Occupancy Date (BOD) of the National Weather Center (NWC), NOAA will relocate its National Severe Storms Laboratory (NSSL), Norman Weather Forecast Office (WFO), Storm Prediction Center (SPC), Warning Decision Training Branch (WDTB) and NEXARD Radar Operations Center's (ROC) Application Branch to the NWC. The rent payments for FY 2006 will be $0.234M per month or $1.87M for 8 months of NOAA occupancy of the NWC. Current NOAA lease costs that can be applied to this new rental costs are $0.52M a year ($0.35M for the eight-month period of FY2006) for a total net new requirement of $1.52M. The net total full-year requirement will be $2.29M, beginning in FY 2007.

NOAA Research also requests the following transfers between line offices for a net change to NOAA of zero.

From Office	Line	To Office	Line	Amount
OAR	Climate Change Research Initiative	NWS	Local Warnings and Forecasts Base	- $3,200,000
OAR	Laboratories & Joint Institutes	OMAO	NOAA Corps	-$20,000
OAR	Ocean Exploration	OMAO	NOAA Corps	-$20,000
OAR	Climate Laboratories & Joint Institutes	USAO	Office of General Counsel	1 FTE and -$14,000
OAR	US Weather Research Program	NWS	US Weather Research Program	-500,000

The $40,000 transferred to OMAO partially funds NOAA Corps Officer positions that benefit OAR. The General Counsel FTEs are being realigned to reflect funding of these FTE through the Office of General Council within Program Support. The General Counsel funding is being realigned to alleviate a shortfall in funding for that office. The $500,000 transferred to the NWS funds the US Weather Research Program in that line office.

The map below shows the locations of OAR Laboratories, National Undersea Research Centers, Joint Institutes, International Research Institute, and Sea Grant Colleges and States.



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Subactivity: Climate Research
Line Item: Laboratories & Joint Institutes

GOAL STATEMENT:

The goal of the Climate Laboratories and Joint Institutes is to develop a more comprehensive understanding of atmospheric and oceanic processes that drive and respond to changes in climate over a variety of spatial and temporal scales, in order to better predict climate variability and change and help the Nation respond to the risks and opportunities associated with global climate change.

BASE DESCRIPTION:

In FY2006, the OAR Laboratories and Joint Institutes will be included in the U.S. Climate Change Science Program's (CCSP) Our Changing Planet, in recognition of their roles as an integral part of the interagency CCSP, which links the U.S. Global Change Research Program (USGCRP) and the Administration's Climate Change Research Initiative (CCRI). OAR Laboratories and Joint Institutes conduct a wide range of research into complex climate systems and how they work. The research aims to improve NOAA's ability to assess climate variability on seasonal to interannual timescales, as well as interdecadal to centennial timescales and beyond. NOAA researchers strive for consistent and uninterrupted monitoring of the Earth's atmosphere that can give us clues about long-term changes in the global climate. The data collected worldwide by NOAA researchers aids our understanding of, and ability to forecast changes in, complex climatic systems. Using sophisticated computer systems, NOAA researchers work on numeric modeling of climate systems that will help improve the accuracy of climate forecasts. NOAA's strategy is to: (1) acquire the essential data; (2) develop diagnostic and predictive models related to changes in the equatorial oceans; and (3) establish the relationship of those changes to widespread climate variations through data analysis and modeling.

Base activities support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Climate Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Laboratories & Joint Institutes					
Laboratories & Joint Institutes (C)	44,163	42,860	44,627	44,627	-
Laboratories & Joint Institutes (MS)	1,700	1,774	1,845	1,845	-
Laboratories & Joint Institutes (WW)	1,383	1,413	1,469	1,469	-
TOTAL	47,246	46,047	47,941	47,941	-
FTE	252	250	249	249	-

PROGRAM CHANGES FOR FY 2006:

None.

Subactivity: Climate Research
Line Item: Climate & Global Change Program

GOAL STATEMENT:

NOAA's Climate and Global Change goal is to establish a national information service based on reliable assessments and quantitative predictions of global climate change. This service will help NOAA provide high-quality predictions and assessments to the public and private sectors, other Federal and state agencies, and the international community. The near-term objective is to provide reliable predictions of global climate changes, both natural and human-induced, and their associated human effects on time scales ranging from seasons to that of a century or more.

BASE DESCRIPTION:

NOAA's Climate and Global Change Program is an integral part of the interagency U.S. Climate Change Science Program (CCSP), which links the U.S. Global Change Research Program (USGCRP) and the Administration's Climate Change Research Initiative (CCRI). The program addresses an important aspect of global change - understanding the global climate system - and advances research and assessment activities designed to address the interface between scientific information and society's various decision-making needs. Current research activities are organized across the following program elements:

The **Atmospheric Composition and Climate Program** pursues two overall research objectives: (i) to improve the predictive understanding of the radiative forcing of the climate system by aerosols (airborne fine particles) and by chemically-active greenhouse gases, such as tropospheric ozone, and (ii) to better characterize the recovery of the stratospheric ozone layer and its role in climate change. The integrated research activities that address these objectives involve instrument development, global observations, laboratory studies, and theoretical modeling by NOAA and extramural partners. A hallmark of the Program is that its research contributes to the projects of the International Global Atmospheric Chemistry (IGAC) program of the International Geosphere-Biosphere Programme (IGBP), and the Stratospheric Processes and their role in Climate (SPARC) program of the World Climate Research Program (WCRP).

The **Climate Change Data and Detection (CCDD)** program element ensures that the data needed to understand the climate system is available for analysis. The data and resultant products extend the existing long-term climate record and serve as essential input to predictive models. In addition, CCDD provides support for documenting variations in climate on time scales ranging from less than one year to periods of 100 years and longer. Support is also provided for the analysis of observed climate variations and identifying causes that are consistent with Earth's long-term climate history.

The **Climate Dynamics and Experimental Prediction (CDEP)** program element supports NOAA's efforts towards improved global climate predictions on seasonal to interannual timescales through the Applied Research Centers (ARCs). The ARCs comprise a set of centers committed through a critical mass of technical and intellectual resources, to tackle in a sustained manner, problems inherent in implementing climate services for the Nation. The ARCs help develop and support climate services through a program of basic and applied research, development, and experimental applications, leading to a

coordinated suite of critical contributions to the predictions and assessments of climate variability and regional assessments and applications produced by NOAA's Climate Prediction Center (CPC) and the International Research Institute for Climate Prediction (IRI).

The ultimate goal of the NOAA **Climate Variability and Predictability (CLIVAR)** program element is to develop skillful predictions of climate variability and change on seasonal to multi-decadal time scales and regional spatial scales for optimal use in resource planning and policy decision making. The scientific objective of the NOAA CLIVAR program is to understand the mechanisms of major patterns of climate variability and change on seasonal to decadal and longer time scales and to develop the predictive capability for these patterns of climate variability. Initial focus of the leading large-scale patterns include the El Nino-Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), Tropical Atlantic Variability (TAV), Arctic Oscillation/North Atlantic Oscillation (AO/NAO), and the American Monsoon systems. CLIVAR research approaches include development of observational, theoretical, and computational means to understand and predict climate variability and change and making enhanced predictions, where feasible.

The **Climate Prediction Program for the Americas' (CPPA)** element merges NOAA's CLIVAR Pan American Climate Studies and Global Energy and Water Cycle Experiment (GEWEX) Americas' Prediction Project into a single integrated competitive research program to improve operational intra-seasonal to interannual climate and hydrologic forecasting. CPPA seeks to i) improve the understanding and model simulation of ocean, atmosphere and land-surface processes through observations, data analysis, and modeling studies; ii) determine the predictability of climate variations on intra-seasonal to interannual time scale, including predictability of the continental-scale monsoon systems across the Americas; iii) advance NOAA's operational climate forecasts, monitoring, and analysis systems; and iv) develop climate-based hydrologic forecasting capabilities and decision support tools for water resource applications.

The **Global Carbon Cycle (GCC)** program element seeks to improve our ability to predict the sources and sinks of anthropogenic CO2 and future atmospheric CO2 concentrations using a combination of atmospheric and oceanic global observations, process-oriented field studies, analysis, and modeling. The GCC program is a part of the interagency Carbon Cycle Science initiative of the U.S. Global Change Research Program (USGCRP). Background information on the scientific justification for the integrated carbon cycle program can be found in the Carbon Cycle Science Plan (1999) and the North American Carbon Plan (2002), and the Ocean Carbon and Climate Change Plan (2004). GCC research is integrated across four major research elements that work in concert toward achieving NOAA's climate forecasting goals, including the advancement of our understanding of the global carbon cycle and its role in regulating climate.

The **Health and Human Dimensions** program aims to (1) improve our understanding of how social and economic systems are currently influenced by climate fluctuations on seasonal to interannual timescales, and how human behavior can be (or why it may not be) affected based on information about variability in the climate system; and (2) understand the pathways through which climate affects human health and explore opportunities for applying that information for public health policy and decision-making. Social science research on climate-human interactions plays an important role in determining how humans currently prepare for and responds to climate variability and how these interactions could improve human welfare.

The **Regional Integrated Sciences and Assessments (RISA)** program supports research on the status, trends, influencing factors and future projections of evolving interactions between the physical and social environments and on associated decision-making needs over different spatial and temporal scales, within the U.S. The "regional" scale offers an appropriate organizational unit on which to coordinate research on the environmental-societal interface, and on which socially relevant information can be created and provided that is cognizant of geophysical and jurisdictional boundaries. RISA research focuses on the integration of three major coordinates: (1) climate and environmental science; (2) economic and human dimensions, especially on factors influencing climate-sensitive human activities (water resources, agriculture, energy, public health, disaster management, etc.); and (3) applications, i.e., the tools, institutional linkages, and mechanisms needed for effective decision support.

The **Environment, Science, and Development (ESD)** program is designed to further the development of innovative, place-based approaches to understanding and enhancing the interactions between humans, climate and the environment, and to link these outcomes and methods to real world challenges associated with natural resource management, vulnerability reduction and sustainable development. Within this context, the ESD (1) advances focused interdisciplinary scholarship on the role and use of science and technology in the context of reducing vulnerabilities to climate and fostering sustainable growth and development; (2) provides useful insight and empirical information to the scientific community regarding research and information needs, effective methods for enhancing interaction between humans and their environment through science and technology, and opportunities related to the application of climate information with regards to the practical challenges associated with natural resource management, natural hazard preparedness and long-term development; and (3) explores and fosters the scientific, institutional and technical capacities and methods which are essential for optimizing the utility of climate research. This last element includes activities funded jointly by NOAA and the U.S. Agency for International Development (US/AID), e.g., the Climate Information Project.

The research funded through the Climate and Global Change (C&GC) program is highly supportive of and forms a foundation for the President's Climate Change Research Initiative (CCRI). In order to strengthen even further its focus on CCRI priorities, $6,700,000 from the C&GC Climate Variability and Predictability (CLIVAR) Program will contribute to the building of a sustained ocean observing system, consistent with priorities developed by the CLIVAR science community. Specifically, the redirected funds will be used to implement United States contributions to the global tide gauge network, the ships of opportunity program, and the moored and drifting arrays as described in the Climate Observations and Services narrative.

Base activities support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Climate Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Climate & Global Change Program					
Climate and Global Change	68,175	66,039	57,405	57,405	-
Accelerating Climate Models - IRIS	1,484	1,478	-	-	-
TOTAL	69,659	67,517	57,405	57,405	-
FTE	58	67	67	67	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006:

The following programs, or portions thereof, have been terminated in FY 2006: Climate & Global Change ($9,144,000), Accelerating Climate Models - IRIS (1,478,000).

Subactivity: Climate Research
Line Item: Climate Observations & Services

GOAL STATEMENT:

This program aims to reduce impacts to the Nation from climate variations and change by monitoring the Earth's climate system, delivering data, predictions, and impact assessments, and continuing performance-enhancing research.

BASE DESCRIPTION:

The Climate Observations and Services Program (COSP) represents a multi-line organization activity managed as an integrated program. COSP is an integral part of the interagency U.S. Climate Change Science Program (CCSP), which links the U.S. Global Change Research Program (USGCRP) and the Administration's Climate Change Research Initiative (CCRI). The program affects a transition of research observing and data systems and knowledge into operational systems and products. NOAA activities supporting the CCRI are also administered under the Climate Observations and Services Program and are described at the end of this section. The Program is jointly managed by OAR, NESDIS, and NWS. Beginning in FY 2006, the Climate Observations and Services Program lines have been restructured as indicated below.

Climate Research & Observations: The foundation of climate products and services is through applied research and observations of the climate system. Additional observation efforts are dedicated to a multi-agency effort to better quantify, understand, and project the evolution of global carbon sources and sinks to better predict future climate. NOAA is installing a network of airborne and tall-tower based sampling sites over North America that will complement local-scale process research managed by other agencies and provide an estimate of the magnitude of regional terrestrial sinks on a continental scale. This activity is augmented under the CCRI.

NOAA is also establishing and maintaining the sustained global ocean observing system necessary for climate research and prediction as well as the long-term monitoring system necessary for climate change detection and attribution. NOAA's funds are managed in cooperation with the National Ocean Partnership Program (NOPP), whose function is to integrate existing and new ocean observational efforts of the NOPP agencies and their partners to facilitate broad user access to ocean knowledge, data, tools, and products. This integrated approach to ocean observations enables the U.S. to more effectively meet shared observational and prediction needs covering the wide range of ocean research and operational requirements of the NOPP agencies. NOAA's ocean climate contributions provide the major U.S. contribution to the Global Component of the U.S. Integrated Ocean Observing System. . All of NOAA's contributions to the global ocean observing system are managed internationally in cooperation with the Joint WMO/IOC* Technical Commission for Oceanography and Marine Meteorology (*WMO: World Meteorological Organization. IOC: Intergovernmental Oceanographic Commission of the United Nations Educational, Science, and Cultural Organization). The observation network is based on a set of core observations (e.g., temperature, surface wind stress, salinity, sea level, CO2), consisting of both in situ and remotely sensed measurements that have been identified in national and international reports as needed to satisfy research and operational climate requirements. Initial investments in the ocean observing system include:

- ***Argo Floats:*** These floats, together with satellites, will initiate the oceanic equivalent of today's operational observing system for the global atmosphere. This is a truly international effort with 14 nations plus the European Union providing floats at this time.

- ***Surface Drifting Buoys*****:** Sea surface temperature is the single most important ocean parameter for the global heat, water, and carbon cycles. A global array of 1,250 surface drifting buoys is maintained by NOAA and 14 international partners to calibrate satellite observations and reduce errors in global measurement of this critical ocean climate parameter. The drifters also measure surface currents globally and provide critical sea surface data under hurricanes to help improve hurricane landfall projections.

- ***Tide Gauge Stations****:* Sea level rise is one of the most immediate impacts of climate change. NOAA in cooperation with 64 nations is implementing the Global Climate Observing System (GCOS) sea level reference network of 170 tide gauge stations. The stations report in near-real-time and are also used for the tsunami warning system and other marine services.

- ***Tropical Moored Buoys****:* The Earth's tropics are the ocean's major capacity for heat exchange with the atmosphere. The Pacific El Nino influences climate and weather globally. Together with international partners, NOAA is working to instrument all three tropical oceans – the Pacific, Atlantic, and Indian Ocean.

- ***Ocean Reference Stations:*** NOAA, in cooperation with the National Science Foundation and international partners, is implementing a sparse global network of ocean reference station moorings, expanding from the present three pilot stations to a permanent network of 16 by 2010. These have been a cornerstone of decadal-to-centennial documentation of changes in ocean properties, and will also improve seasonal-to-interannual forecasting ability by providing calibration/validation data for remote sensing of surface flux fields. This network also monitors ocean transports to identify changes in circulation that could provide possible indications of abrupt climate change.

- ***Ships of Opportunity (SOOP):*** The global atmospheric and oceanic data from ships of opportunity have been the foundation for understanding long-term changes in marine climate and are essential input to climate and weather forecast models.

- ***Ocean Carbon:*** Projecting decadal to centennial global climate change is closely linked to assumptions about feedback effects between the ocean and atmosphere related to sequestering of carbon in the ocean and additional input of carbon dioxide into the atmosphere. Autonomous carbon dioxide sampling instruments added to the moored arrays and the SOOP fleet and NOAA in cooperation with the National Science Foundation and international partners is implementing an ongoing ocean carbon inventory that will survey the globe once every ten years.

- ***Arctic Ocean Fluxes:*** Over the past 20 or more years, significant changes have been noted in the Arctic, such as thawing of permafrost, earlier break-up of ice on rivers, and thinning of the ice cover on the Arctic Ocean. NOAA is joining with other Federal agencies and international

collaborators to begin a long-term effort to quantify the flux of fresh water from the Arctic to the North Atlantic. The initial steps will be made through deployment of moorings at critical locations in the Arctic.

- ***Dedicated Ships:*** Ocean research vessels from NOAA and university partners are an essential element of the support infrastructure necessary to sustain the ocean observing system. The dedicated ships provide the highest quality reference data sets, provide the platforms for the ocean carbon surveys, and provide platforms for deployment of the moored and drifting buoys and the Argo floats.

- ***Data Management and Data Assimilation:*** A robust and scalable data management infrastructure is essential to the vision of a sustained ocean observing system. The data must be retained and made available for retrospective analyses to understand climate change and for managing observing system operations and improvements. NOAA is a major contributor to the Global Ocean Data Assimilation Experiment.

Marking the successful transition of the TAO array from research to operations, NOAA proposes to transfer the $3,200,000 responsibility for the TAO array in base from NOAA Research to the National Weather Service in FY 2006, which will manage the array as an operational system.

Climate Research and Operations has also included funding support over the past several years for weather-climate connection research, observing capabilities at the Baseline Observatories, regional research applications and assessments, and climate change assessments. Funding for these efforts, however, was not provided in the FY 2005 appropriation. Restoration of these mission-critical efforts are requested in the program change section below.

Climate Data & Information: This program has supported over the past several years the Climate Reference Network, development of reference data sets, and the Observing System Monitoring Program. However, funding for these efforts was not provided in the FY 2005 appropriation. Restoration of these mission-critical efforts is requested in the program change section below.

Climate Operations: This budget line has supported over the past several years the operational applications of improved climate forecasts and delivery of climate information to local forecast offices. However, funding for these activities was not provided in the FY 2005 appropriation. Restoration of these mission-critical efforts is requested in the program change section below.

Climate Change Research Initiative: In a June 11, 2001 speech, President Bush announced the establishment of the U.S. Climate Change Research Initiative to study areas of scientific uncertainty and to identify priority areas where investments can make a difference. The CCRI promotes a vision focused on the effective use of scientific knowledge in policy and management decisions and continual evaluation of management strategies and choices. The proposed strategy emerged from a common sense of priority actions and is aligned with the National Academy of Sciences recommendations presented in its June 2001 report entitled *Climate Change Science: An Analysis of Some Key Questions.* The specific proposed actions have a dual aim:

- To reduce the present uncertainties in climate science and advance climate modeling capabilities
- To develop research and data products that will facilitate the use of scientific knowledge to support policy and management decisions.

In addition, an interagency Climate Change Science Program Office (CCSPO) is established to support our Nation's interagency climate and global change program, including the implementation of the President's CCRI. The following sections describe initial investments, which will address key priorities of the CCRI.

Elements of the CCRI include:

- ***Climate Modeling Center:*** Climate models are essential tools for synthesizing observations and theory to investigate how the climate system works and how it is affected by human activities. The continued development and refinement of computational models that can simulate the past and future conditions of the Earth system is crucial for developing capabilities to provide more accurate projections of future change. The Climate Modeling Center will enable the Geophysical Fluid Dynamics Laboratory to take the national lead in the systematic production of model-based products, developed in consultation with stakeholders. It will also document, understand, and assess the impacts of climate variability and change on the U.S. that can be used for policy and business decisions.

- ***Global Climate Atmospheric Observing System****:* While the national system has made a start in the design and operation of a climate reference network, developing countries in particular have often been unable to maintain observing schedules or to transmit the information effectively. NOAA will work with other developed countries to reestablish the benchmark upper-air and surface networks, emphasizing data sparse areas, and place new Global Atmosphere Watch stations in priority sites to measure pollutant emissions, aerosols, and ozone in specific regions.

- ***Global Ocean Observing System:*** An initial ocean observing system designed to accurately document climate-scale changes in ocean heat, carbon, and sea-level change has been established. The initial system, however, lacks global coverage and major issues remain in better determining parameters such as fields of sea-surface temperature and surface fluxes. There is also a crucial need to systematically provide continuous, three-dimensional fields of several variables for the ocean, including heat content, salinity, currents, wind, pressure, and precipitation. The global tropical moored buoy network is in need of expansion to provide both ocean and atmospheric observations to understand and document heat uptake and release by the ocean. The Global Ocean Observing System will provide the U.S. and its international partners with critical information on the role of the ocean in climate and the rate of climate change through changes in heat storage and global transport. The ocean data will be used to develop, test, and initialize comprehensive climate models. It will also be used to monitor key locations in the ocean for signs of possible abrupt climate change.

- ***Aerosol-Climate Interactions:*** Aerosols and tropospheric ozone play unique but poorly quantified roles in the atmospheric radiation budget. Research will focus on a better understanding of the absorption and scattering of radiation by aerosols (fine airborne particles) and the associated

heating and cooling roles in the climate system. NOAA will contribute to the interagency National Aerosol-Climate Interactions Program (jointly with the National Aeronautics and Space Administration, the Department of Energy, and the National Science Foundation (NSF)). Goals are to: (1) establish new and augment existing in-situ monitoring sites, in and downwind of major population areas (e.g., Asia, Eastern North America, and South America) to determine temporal and spatial distributions, trends, and aerosol chemical and radiative properties and (2) develop integrated models used to study regional patterns, evaluate our understanding of source and sink processes, and project future distributions. In collaboration with NPOESS, the program will evaluate and advance the development of algorithms and establish the appropriate in-situ measurements for the calibration and validation of the NPOESS data. In addition, research will directly address the development of better decision-support tools that will improve the linkage between sources of emissions of compounds that are or lead to climate-relevant aerosols and the resulting regional distributions that cause the climate radiative forcing.

- ***Carbon Monitoring:*** Scientific understanding of the carbon cycle has now advanced to the point where a small number of targeted investments can yield major returns in five years. This monitoring program will provide decision-makers, resource managers, and the American public with solid, quantitative information on the role of the U.S. as both a source and a sink for carbon. The information gathered will be useful for international negotiations and identifying regions where mitigation activities are most needed or would have the most impact. Similarly, projections of climate change, and the scenarios used to inform assessments, will be improved and additional insights into the societal risks of climate change and human efforts to mitigate climate change will be derived. Recent advancements in the program include expansion of a pilot program using small aircraft and tall towers to profile carbon gases. With input from other agencies, this program forms the foundation for routine spatial carbon "maps" and periodic "State of the Carbon Cycle" reports that will keep scientists and policy-makers abreast of progress in understanding the North American carbon cycle. The first of these reports will form the basis for a Climate Change Science Program (CCSP) Synthesis Assessment Report due in FY2006.

- ***Regional Integrated Science Assessments:*** This component of the CCRI directs additional resources to the NOAA Regional Integrated Science and Assessment (RISA) program, working in conjunction with research on decision and risk management by NSF. This innovative interagency approach links RISA's place-based research and applications activities with NSF's more methodological research in how to manage risks associated with the uncertainty of climate change. NOAA will implement demonstrations across the regions in areas such as water management, disaster reduction, fire management, health, and agricultural decision-making.

Base activities support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Climate Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Climate Observations & Services					
Climate Observations & Services	-	-	-	-	-
Climate Research and Observations	20,411	13,707	14,231	17,464	3,233
Climate Operations	1,025	-	-	895	895
Climate Data & Information	3,957	-	-	3,313	3,313
Climate Change Research Initiative	22,356	39,427	36,962	47,555	10,593
TOTAL	47,749	53,134	51,193	69,227	18,034
FTE	33	20	20	31	11

PROGRAM CHANGES FOR FY 2006:

The NOAA Climate Program was rated "Moderately Effective" on the OMB Program Assessment Rating Tool (PART) for FY 2006. As a result of this, the FY 2006 President's Budget Request provides the NOAA Climate Program with increases, specifically for activities that support priorities identified in the Strategic Plan for the U.S. Climate Change Science Program.

Climate Observations & Services (+11 FTE and +$7,441,000): NOAA requests an increase of 14 FTE and $7,441,000 to reactivate those formerly base activities under:

- Climate Research and Observations (+8FTE and $3,233,000),
- Climate Operations (+1 FTE and $895,000), and
- Climate Data and Information (+2 FTE and $3,313).

These activities are essential to the accomplishment of key NOAA missions. These programs will serve as a foundation for NOAA's participation in the interagency U.S. Climate Change Science Program by providing the base support that is fundamental to the success of the research conducted under the Climate Change Research Initiative. This funding will ensure continuation of the climate observing networks and long-term climate records that are essential to today's climate research and will further the development of operational climate products and services. Specific program increases are described below.

Proposed actions:

- **Climate Research and Observations (+8 FTE and +$3,233,000):** This funding would provide support for NOAA's Baseline Observatories, Weather-Climate Connection research (improving forecasts between weather and climate timescales), regional stakeholder-involved research (enabling more effective application of climate information), and activities supporting NOAA's involvement in national and international assessments.

  Baseline Observatories: Atmospheric observing systems are necessary for long-term monitoring of climate-relevant atmospheric parameters, supplying information on global carbon dioxide, the state of recovery of the ozone layer, the atmospheric concentration of other trace gases impacting the global climate, and the quality of air entering the west coast of the U.S. The Baseline Observatories accommodate long-term atmospheric monitoring capabilities at five locations around the globe, two of which provide the longest instrument record of atmospheric carbon dioxide (47-years at the Mauna Loa, Hawaii and South Pole Observatories). Other climate variables measured include non-carbon dioxide greenhouse gases, aerosols, and solar and terrestrial radiation. The funding request would support full-time staffing of the Mauna Loa observatory, the flagship of the observatories, as well as staffing support for the Pt. Barrow, Alaska; American Samoa; and South Pole Observatories. Long-standing partner programs, such as that with the Scripps Institute of Oceanography Carbon Dioxide Program and numerous extramural partnerships, will be supported by two contractor employees at the Mauna Loa Observatory. Funding would also enable NOAA's continued significant contribution to the Dobson spectrophotometer total ozone global network (includes 20 stations plus the WMO World Standard instrument used to calibrate about 80 global ozone-layer measurements). Finally, the South Pole Observatory would build upon 18 consecutive years of monitoring the vertical profile of Antarctic ozone depletion at the South Pole. This is critical for assessing the impacts of the Montreal Protocol and other remedial actions aimed at reducing stratospheric ozone depletion.

  Regional Climate Research: Funding would also support stakeholder-involved climate research in targeted regions of the U.S. through the RISA and NOAA Climate Transition Programs (NCTP), which develop new research applications of climate information for ultimate operational use by resource managers in such societal sectors as energy, water supply/drought management, fisheries, wild land fire management, and agriculture. Funding would enable the eight current RISA teams to extend the scope of their research activities, including research supporting development and implementation of the National Integrated Drought Information System. NOAA would continue to develop impacts reports and publications, engage user communities, and develop and transfer applications of climate research and information to operational end-users. These activities are critical to NOAA's vision for an end-to-end suite of climate products and services.

  Climate Change Assessments: Climate assessments and synthesis reports are the culmination of NOAA research and observations and serve as key tools for effective policy and decision support. Funding would enable travel of NOAA scientists to fulfill national and international assessment commitments, National Research Council reviews, scoping workshops, and the production and distribution of assessment products. These products include the Intergovernmental Panel on Climate Change reports, WMO Ozone Assessments, and U.S. Climate Change Science Program synthesis and assessment products. This funding would maximize the impact of NOAA's climate research through the dissemination of information products that serve the Nation.

Weather-Climate Connection: This funding would support forecasting research for the development of improved forecasts of extreme events (e.g. floods, heat waves, severe weather), hydrologic (water supply) forecasts, monthly forecasts through an extension of weeks 3-4 reforecasting techniques, and development of multi-model ensemble reforecast methods. Funding would also allow for follow-through on data collection costs as part of a P-3 aircraft deployment documenting atmospheric rivers over the central Pacific ("atmospheric rivers" are a key water cycle process affecting weather patterns over the U.S.). Preliminary efforts in these areas have already led to a successful research-to-operations transition, as demonstrated with significant improvements in forecasting skill at NOAA's Climate Prediction Center through the application of reforecasting methodologies developed in coordination with NOAA Research.

Benefits

- Continuation of long-term monitoring of climatologically important atmospheric properties, critical to tracking changes in long-term trends, including greenhouse gases (e.g. carbon dioxide and methane), stratospheric ozone depletion, and surface radiation.
- Improved forecasting capabilities over timescales from weeks to seasons, including improved forecasts of extreme weather events, and improved delivery of forecast information to local communities.
- Development of new applications for climate information in resource management sectors, such as fisheries, energy, and drought/water.

Performance Goals and Measurement Data:

This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Many of the activities described above provide support for several U.S. Climate Change Science Plan synthesis and assessment products (Reanalyses of Historical Climate Data, Climate Extremes, Decision Support Experiments, Aerosols, and Ozone). The scope of these products would be limited without the requested funding. The increase will contribute to both of the NOAA Strategic Plan Climate Goal outcomes for (1) A predictive understanding of the global climate system on time scales of weeks to decades with quantified uncertainties sufficient for making informed and reasoned decisions and (2) Climate-sensitive sectors and the climate-literate public effectively incorporating NOAA's climate products into their plans and decisions. The following performance measures will be supported by the requested increase:

Performance Measure	2006 w/o Incr.	2006 Est.
Reduce uncertainty in magnitude of North American carbon uptake (GPRA)	0.48 GtC/yr	0.4 GtC/yr
Improve society's ability to plan and respond to climate variability and change using NOAA climate products and information (indicator: number of peer-reviewed risk and impact assessments/evaluations published and communicated to decision makers)	28	32
Increased skill in week-two forecasts of extreme US temperature events (indicator: Brier Skill score x 100)	1	3
Increased skill in week-two forecasts of extreme US precipitation events (indicator: Brier Skill score x 100)	0	1

- **Climate Operations (+1 FTE and +$895,000):** The impacts of seasonal and interannual climate variability manifest themselves on regional and local levels. As NOAA develops improved seasonal and interannual forecasting capabilities, it must also develop pathways to provide routine forecast information to stakeholders and partners, including regional and local managers and decision-makers, in order to maximize economic gain and mitigate potential harmful impacts from climate variability and change. Programs receiving support under this budget line provide an operational interface between users and providers of reliable climate products and services. Funding would also support local weather forecast office efforts to provide a full-range of customer services for NOAA climate products, including new local forecast products. Part of this funding is also critical for the effective transfer of new long-range forecasting techniques to operational settings within the National Weather Service, and would complement the research activities described above under the Weather-Climate Connection. Funding would further support the NOAA Climate Test Bed through the evaluation and diagnostics of NCEP's new Climate Forecast System, the development of multi-model ensembles for climate, and the development of new climate forecast applications.

  Benefits
  - Improved operational forecasting capabilities over timescales from weeks to seasons, including improved forecasts of extreme weather events.
  - Improved delivery of forecast and climate information to local communities and resource management sectors.

  Performance Goals and Measurement Data:
  This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Climate Operations will support two U.S. Climate Change Science Plan synthesis and assessment products (Reanalyses of Historical Climate Data, Climate Extremes). The scope of these products would be limited without the requested funding. The increase will contribute to the NOAA Strategic Plan Climate Goal outcome: A predictive understanding of the global climate system on time

scales of weeks to decades with quantified uncertainties sufficient for making informed and reasoned decisions. The following performance measures will be supported by the requested increase:

Performance Measure	2006 w/o Incr.	2006 Est.
*U.S. Seasonal Forecast Skill (GPRA) **	18	18

*this measure is under revision

- **Climate Data and Information (+2 FTE and +$3,313,000):** This funding would support the U.S. Climate Reference Network (USCRN), the development of satellite reference climate data sets, and the Observing System Monitoring Program.

  The **U.S. Climate Reference Network** provides baseline, high-quality surface observations of air temperature and precipitation in order to better detect long-term changes in climate through a robust climate record. The Climate Reference Network is an integral component of NOAA's plans for an Integrated Surface Observing System and contributes to the integrated Global Earth Observing System of Systems (GEOSS). USCRN observations will provide benchmark measurements for an improved National climate and weather monitoring network. CRN data already serve over 100,000 users each year from government, academia, and the private sector. Funding will provide for the costs related to reactivating and commissioning 12 stations, maintenance and operations of installed and commissioned stations, and the installation and commissioning of four (4) new stations. The requested funding would enable NOAA to continue its plans toward full implementation of the network of reference stations, with the ultimate goal of routinely explaining at least 95% of national annual average precipitation variance and 98% of national annual average temperature variance for the contiguous U.S. Without the requested funding, the network would remain only partially complete (58 commissioned out of 110 planned stations) and the 12 stations in hibernation would eventually be removed due to insufficient operating and maintenance support funds. The requested funding would enable NOAA to complete the planned network of 110 stations by early 2009.

  Funding for satellite **reference climate data sets** would contribute to continued processing required to merge data from NOAA, NASA, and international satellites. The capability to blend these observations will enable scientists to track changes in global cloud cover, currently a fundamental uncertainty in understanding climate. Addressing this shortcoming is required for many energy-related applications. The funds would be used to transform complex data on cloud properties, surface albedo, ice, reflectance, radiance, and temperature into common data formats, improving access to and application of the data.

  Funding would also support NOAA's **Observing System Monitoring Program**. This program provides early detection and remediation of network problems that can adversely affect the quality of data records and diminish our ability to evaluate climate variability and change. It alerts Observing System Managers in near real time to problems that in the past have been discovered long after the data became part of the historical archive, and thus too late to take immediate corrective action. Funding would enable continued routine monitoring for the U.S.

Climate Reference Network, NWS Cooperative Observer Network, the Global Climate Observing System (GCOS) Upper Air Network, and expand monitoring to the other NOAA observing systems such as the GCOS Surface Network, the U.S. Integrated Upper Air Observing Stations, and others. These observing systems are fundamental to our Nation's and the global climate and weather monitoring programs.

Benefits:

- Continuation of long-term climate monitoring of surface air temperature and precipitation for improved capabilities to monitor long-term trends in U.S. climate and benchmark observations for satellite measurements and NOAA's planned integrated observing network
- Improved applicability of complex climate datasets and improved observing network performance for more robust long-term climate data.

Performance Goals and Measurement Data:

This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Funding would provide support for several U.S. Climate Change Science Plan synthesis and assessment products (Reanalyses of Historical Climate Data, Climate Extremes, and Temperature Trends in the Lower Atmosphere). The scope of these products would be limited without the requested funding. The increase will contribute to the NOAA Strategic Plan Climate Goal outcome for a predictive understanding of the global climate system on time scales of weeks to decades with quantified uncertainties sufficient for making informed and reasoned decisions. The following performance measures will be supported by the requested increase:

Performance Measure*	2006 w/o Incr.	2006 Est.
Determine the national explained variance (%) for annual average air temperature for the contiguous U.S. using USCRN stations(GPRA)	96.7%	>97%
Determine the national explained variance (%) for annual average precipitation for the contiguous U.S. using USCRN stations (GPRA)	90%	91.2%

* Long-term targets are 98% and 95% for annual average temperature and precipitation trends for the contiguous U.S., respectively. If the uncertainty in precipitation trends reaches the long-term target, we will be able to account for total U.S. precipitation amounts equivalent to roughly 40% of the fresh water in the Great Lakes, relative to the uncertainty in trends, now.

Climate Change Research Initiative (0 FTE and $10,593,000): NOAA requests an increase of 0 FTE and $10,593,000 for a total of 12 FTEs and $49,550,000. The CCRI is composed of several integrated initiatives designed to reduce key scientific uncertainties:

Ocean Observations for Climate (+0 FTE, and +$3,515,000): NOAA requests an increase of 0 FTE and $3,515,000 to continue building and maintaining a global ocean observing system that will accurately document climate-scale changes in ocean heat, carbon, and sea level. This initiative responds to the long-term observational requirements of the operational forecast centers, international research programs, and major scientific assessments. This increase is part of a multi-year, phased implementation initiative that calls for 100% completion by FY 2010. The requested funding would bring the global observing system to 55% completion.

Background: The Ocean is the memory of the climate system and is second only to the sun in affecting variability in the seasons and long-term climate change. It has been estimated that the ocean stores 1,000 times more heat than the atmosphere and 50 times more carbon. Eighty-six percent of the rain and snow that water our earth comes directly from the ocean. The key to possible abrupt climate change may lie in deep ocean circulation, and changing sea level is one of the most immediate impacts of climate change.

The U.S. Climate Change Science Program has identified the critical need for the federal government to begin delivering regular reports documenting the present state of the climate system components. Priorities for accelerated implementation of a sustained ocean observing system for climate have been identified as a central element of the Climate Change Research Initiative. These priorities are consistent with the international *Implementation Plan of the Global Observing System for Climate in Support of the United Nations Framework Convention on Climate Change*, which identifies "the first action of the initial oceanic climate observing system is the global implementation of the surface and sub-surface networks." NOAA will provide a significant portion of the United States contribution to this global effort.

The sustained ocean observing system for climate is a composite of complementary networks, as described above under the Climate Research and Observations. The composite system depends also on continued satellite missions for measurement of global sea surface temperature, sea surface height, surface winds, ocean color, and sea ice from space. Although individual network priorities are described below, they are interdependent and must all go forward together. For example, the U.S. contribution to the Argo array is fully funded by base funds, yet deployment of the Argo floats in the far corners of the ocean cannot be achieved without increased funding for the ships of opportunity and the dedicated ship support included in this initiative. Similarly, the Argo array cannot do its work without global overflight by continued precision altimeter space missions; and the satellite altimeters must be calibrated using a subset of the GCOS reference tide gauges.

NOAA's in situ "system" operations are managed centrally in Maryland while the "individual network" operations, as described below, are focused at distributed centers of expertise in California, Florida, Hawaii, Massachusetts, Mississippi, Virginia, and Washington. Approximately half of this FY 2006 increase will be directed to federal laboratories and centers, and the remaining half will be directed to NOAA's external partners that are central to the implementation strategy.

Proposed Actions: Incremental advancements across all networks will be undertaken in FY 2006 in direct response to the CCRI's emphasis on actions that will bring immediate gain over the next 2 to 4 years:

- Resolve the uncertainties in sea level change and sea surface temperature. Sea level change has the most direct societal impact and sea surface temperature is the single most important variable in the heat, carbon, and water cycles. The immediate plan will be to complete the global subset of tide gauge stations for altimeter calibration and long-term trends identified as the ocean climate reference network.
- Reduce the uncertainty in estimates of changes in the carbon inventory in the global ocean. The exchange of carbon dioxide between the atmosphere and ocean is a major factor in the global carbon cycle. The immediate plan will be to accelerate to add autonomous carbon dioxide sampling instrumentation to the moored arrays and ships of opportunity to analyze seasonal variability and long-term trends in carbon exchange between the ocean and atmosphere.
- Document the ocean's heat storage and transport to identify where anomalies enter the ocean, how they move and are transformed, and where they re-emerge to interact with the atmosphere. The immediate plan will be to advance the implementation of a global network of ocean reference stations to provide validation points for climate forecast and projection models, monitor key locations in the ocean for signs of possible abrupt climate change, and enhance data collection from ships of opportunity, completing a subset of high accuracy lines to be frequently repeated and sampled at high resolution for systematic upper ocean and atmospheric measurements.
- Document changes in the ocean's contributions to the global water cycle. With increasing world population and the changing climate, global distribution of fresh water is rapidly become one of the most important natural resource concerns. Our understanding of the water cycle is limited by our knowledge of oceanic evaporation and precipitation over the ocean – 70% of the earth's surface. The immediate plan will be to instrument the global arrays of moored and surface drifting buoys and ships of opportunity for measurement of sea surface salinity which is a direct indicator of the ocean's evaporation and precipitation.

Benefits:

- Documentation and analysis of long-term ocean variability provides information needed for society to anticipate and adapt to changes in the Earth's climate system.
- Documentation and analysis of the present state of the ocean provides the initial conditions for generating seasonal climate forecasts for better immediate-term economic and management decisions.
- Documentation of oceanic carbon burden assists decision makers in establishing long-range policy for adapting to climate change.
- Documentation and forecasting of sea level change are essential to engineering and land use decisions in coastal regions.

Performance Goals and Measurement Data:

This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Specifically, this increase supports the Climate Performance Goal and the GPRA performance measure, "Reduce the Error in Global Measurement of Sea Surface Temperature." The increase will contribute to the NOAA Strategic Plan outcome for a predictive

understanding of the global climate system on time scales of weeks to decades with quantified uncertainties sufficient for making informed and reasoned decisions.

This funding increase will advance the global ocean observing system to 55% complete. Without this increase, global coverage will be slowed to 52% complete.

Performance Goal: Understanding Climate Variability and Change

Performance Measure	2006 w/o Incr.	2006 Est.
PM: Reduce the Error in Global Measurement of Sea Surface Temperature (degrees C)	0.5°C	0.4 °C

Aerosols, Clouds, and Climate Change: Observations and Predictions (+0 FTE and $2,078,000): NOAA requests an increase of 0 FTE and $2,078,000 for a new five-year observation/modeling-based focus on gaining a better predictive understanding of how aerosols (airborne fine particles) influence climate by their interaction with clouds. This augmentation will complement NOAA's ongoing focus on the direct heating and cooling influences on climate by aerosols. Research conducted in this initiative will fill one of the largest information gaps in our current understanding of the factors that influence climate. Furthermore, the research will support quick-response decision-making that is a high priority in the Nation's efforts to address climate-change issues. This program is a cooperative effort between the Aeronomy Laboratory, the Climate Monitoring and Diagnostics Laboratory, the Environmental Technology Laboratory, the Geophysical Fluid Dynamics Laboratory, and the Pacific Marine Environmental Laboratory in OAR, and externally funded work through OAR/Office of Global Programs

Background: Aerosols induce changes in the climate system because they change cloud properties. This effect of aerosols on changing clouds and cloud properties is recognized as the largest single contributor to the uncertainty in predicting climate change due to human influences and is the basis of this initiative. A better understanding of this phenomenon is deemed to be one of the Nation's top three climate-research priorities, as elucidated by the National Aerosol Climate Interaction Program (NACIP), 2002 and the President's U.S. Climate Change Science Program (CCSP), 2002, and further recognized in the NRC's findings on climate change science, 2001. This initiative on Aerosols, Clouds, and Climate Changes will integrate field studies, laboratory characterization, diagnostic modeling, and decision-support assessment into an end-to-end discovery-information product. NOAA's aerosol-climate research is a keystone of the Climate Forcing component under NOAA's Climate Mission Goal.

Proposed Actions: With the ongoing activities on the direct heating and cooling by aerosols, NOAA has built the intellectual underpinning and the expertise in aerosol research needed to address one of the thorniest of the aerosol-related issues — aerosols and clouds. The initiative aims to substantially augment NOAA aerosol-climate research to include the aerosols/clouds component, thereby aiming to fill a key gap in the current

scientific understanding of one of the major factors that affects climate. To be effective and efficient, in both the near-term (~2007) and the end-of-the-decade timescales associated with the CCRI and CCSP/USGCRP goals, the program seeks to assess and substantially reduce the uncertainty in climate simulations with an improved characterization of how aerosols affect cloud properties. The approach will include integrated field measurements, laboratory studies, modeling, and assessment, carried out in/by various NOAA OAR laboratories and U.S. universities. Specifically, this would involve:

1. observation-based determinations of the effect of aerosols on cloud brightness during FY 2006 field studies over oceans close to the U.S. and a continental site in the Eastern U.S.;
2. quantification of basic processes involved in aerosol effects on clouds by studies under controlled laboratory conditions and over surface sites, to gather information that will improve the models' predictive capability;
3. building a detailed model of the microphysics and aerosol-cloud-radiation interactions using information gained in the studies in tasks (1) and (2); and
4. incorporation of aerosols' impact on climate in global climate models and comparing model results with observations to improve the models' performance.

The result will be an improved capability to simulate global and regional climate change and determine the roles of various aerosols in this change. This will assess/improve the reliability of future climate projection scenarios associated with anthropogenic activity done for CCSP and Intergovernmental Panel on Climate Change (IPCC), as well as help craft the next generation of decision-support needs in the next decade.

Benefits: By characterizing how aerosols influence clouds, this research will address what is currently the most uncertain of the factors that influenced climate change in the past century and those that will influence climate change in the near future. This research will:

- Result in better observationally-based bounds on the effect of the aerosols/clouds factor on climate, in time for the 2007 CCSP and IPCC assessments;
- Provide key input to support second-plateau CCSP deliverables;
- Resolve scientific uncertainty in global climate models and result in better information in support of future management decision tools for providing "if…then…" climate-change scenarios. Such decision-making is crucial for determining optimal types, amounts, and schedules of greenhouse species emissions in this and coming decades;
- Lay the groundwork for a NOAA-sponsored community-wide assessment of the aerosol-related, climate-forcing predictive skills, which will be a major output of the second decade of U.S. global change research.

Performance Goals and Measurement Data:
This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Specifically, this increase supports the Climate Performance Goal and the GPRA performance measures, "*Reduce uncertainty in model simulations of the influence of aerosols on climate.*" The increase will contribute to the NOAA Strategic Plan

outcome for a predictive understanding of the global climate system on intraseasonal through interdecadal time scales with quantified uncertainties sufficient for making informed and reasoned decisions.

Performance Goal: Understanding Climate Variability and Change

Performance Measure	2006 w/o Incr.	2006 Est.
PM: Reduce uncertainty in model simulations of the influence of aerosols on climate	15%	25%

Tropical Buoy Expansion (0 FTE and $3,200,000): NOAA requests 0 FTEs and an increase of $3,200,000 to conduct further research on the Tropical Atmosphere Ocean (TAO) and Pilot Research Moored Array in the Tropical Atlantic (PIRATA) arrays, including expansion of the TAO array into the Indian Ocean, system enhancements, and technology development. This element is managed as a component of the integrated global ocean observing system. Although the Pacific backbone of the TAO array is funded within the NWS budget, it too will continue to be managed as a central component of the integrated ocean observing system and additional research is critical to enhancing TAO's observing capabilities.

Background:
The TAO array across the tropical Pacific Ocean has been indispensable for seasonal-interannual (S/I) forecasting capabilities. The transfer of the tropical pacific TAO array to NWS for operational management is recognition of the role research contributes to enhancing NOAA's services. Expansion of the array and technological development are required to enhance the overall capability of the array to accurately document the state of the ocean climatic conditions and improve our seasonal forecasting capability in a cost-effective manner. A critical part of S/I prediction is the accurate initialization of the ocean component of the coupled ocean-atmosphere S/I forecast model. The initialization of the ocean state is achieved through the assimilation of observations (both in situ and satellite based) into the ocean model. Improvements to the initialization are made through an improved observational data set and by improving the model. After years of relying solely on temperature observations, it is now understood that salinity observations are also required to improve the ocean initialization. The addition of salinity sensors would increase the value of TAO for S/I forecasting. Expansion into the Indian Ocean will better document the state of ocean climatic conditions, addressing intraseasonal climate variations, the Asian Monsoon, and Indian Ocean decadal fluctuations and their potential impacts on El Nino and North American climate, thus improving S/I forecasting.

To improve the model, it is necessary to adjust various model parameters, such as the flux fields (e.g. heat and water) that are used to force the ocean model. The addition of surface radiation and precipitation measurements to components of the TAO array would provide critical reference data that would contribute to these required model enhancements. System upgrades are also needed to bring moorings up to ocean reference station quality for satellite and model validation.

In the Atlantic Ocean, increased observational capabilities are needed to better understand and predict the formation of hurricanes. An expanded Pilot Research Moored Array in the Tropical Atlantic (PIRATA) array in the hurricane genesis region of the Atlantic Ocean is critical to improving our understanding of the effects of ocean-atmosphere interactions on hurricane development.

Proposed Actions: In cooperation with international partners, NOAA proposes to extend the Tropical Moored Buoy Array across the Indian Ocean and to enhance the TAO and PIRATA arrays with the following research activities:

- $1,500,000 for Deployment of 15 additional moored buoys in the Indian Ocean to improve seasonal forecasting capability;
- $300,000 for technological development of the next generation of moored buoys, allowing for easier deployment of buoys. These technological advances will lead to a more cost effective operational TAO array in the future;
- $300,000 for the addition of salinity sensors to the TAO array for enhanced S/I climate forecast capability;
- $500,000 for the upgrade of a subset of four TAO and three PIRATA buoys with the addition of surface radiation and precipitation measurements for validation of surface ocean heat and water fluxes in climate models and calibration of satellite based rainfall estimates over the oceans. These buoys will then be classified as ocean climate reference stations; and
- $600,000 for deployment of four additional buoys to the Atlantic Ocean PIRATA array in the hurricane genesis region of the Atlantic Ocean.

Benefits: TAO and PIRATA array enhancements will result in:

- Complete global monitoring of the Earth's tropics, which are the ocean's major capacity for heat and water exchange with the atmosphere;
- Improved S/I forecast capability through improved observational data sets and improved flux fields in the coupled ocean-atmosphere S/I forecast model;
- Higher quality ocean climate measurements for model and satellite validation; and
- More cost-effective, easier-to-deploy, next-generation moored buoys

The improvements will further enable the program to meet its performance measure targets of reducing uncertainty in sea surface temperature satellite bias error and improving U.S. seasonal temperature forecast skill. Without the FY 2006 funding, further research enhancements to the expansion of the TAO in the Indian Ocean and improvements to current moorings will not be possible. Reductions in uncertainty of sea surface temperature will also be delayed.

Performance Goals and Measurement Data:
This increase will support the objective, “Advance understanding and predict changes in the Earth’s environment to meet America’s economic, social, and environmental needs” under the Department of Commerce Strategic Goal of “Observe, protect, and manage the Earth’s resources to promote environmental needs.” Specifically, this increase supports the Climate Performance Goal and the GPRA performance measure, “Reduce the Error in Global Measurement of Sea Surface Temperature.” The increase will also enhance NOAA’s integrated ocean climate observing

system, contributing to the NOAA Strategic Plan outcome for a predictive understanding of the global climate system on time scales of weeks to decades with quantified uncertainties sufficient for making informed and reasoned decisions.

Performance Goal: Understanding Climate Variability and Change

Performance Measure	2006 w/o Incr.	2006 Est.
PM: Reduce the Error in Global Measurement of Sea Surface Temperature (degrees C)	0.5°C	0.4 °C

Explaining Climate Conditions to Improve Predictions (+0 FTE and $2,000,000): NOAA/OAR is requesting 0 FTE and $2,000,000 to develop new climate reanalysis data sets and the capability to deliver explanations of the causes for observed climate variability and change. This effort represents a key NOAA contribution to the CCSP goal of improving knowledge of the Earth's past and present climate and environment, including its natural variability, and improve understanding of the causes of observed variability and change. This work will enable NOAA, as the lead agency, to deliver a high priority interagency CCSP synthesis product in 2-4 years: "Reanalyses of historical climate data for key atmospheric features. Implications for attribution of causes of observed change." This program component supports NOAA's Mission Goal to "Understand climate variability and change to enhance society's ability to plan and respond."

Background: NOAA lacks adequate capacity to provide global climate analyses that are required to describe major features of 20th-century climate and the capacity to address the causes of observed regional climate variations that are crucial to informing policy decisions. The first-generation reanalyses, based on mid-1990's models, lack adequate spatial resolution and contain known deficiencies which limit their usefulness for identifying climate trends and assessing causes of observed change. Advances in models, improved data assimilation methods, and new data sources make it desirable and feasible for NOAA to develop and continually update global reanalyses datasets. An assessment of the causes of observed changes will complement the data set development and enable NOAA to meet CCSP synthesis product requirements.

Proposed Actions: Developing improved climate reanalyses and attribution capabilities requires strong links among NOAA's observational, research, and operational prediction efforts. This program enhancement will establish the capacity to produce consistent and continually updated climate analysis data sets; to expand climate services through the delivery of regular and systematic explanations of the state of the climate system; and to advance understanding and predictions of climate extremes for proactive decision-making.

Activities at NESDIS' National Climatic Data Center will provide new, quality-controlled data products that will serve as crucial observational input for an historical reanalysis. Observational data sets will be constructed with at least once-daily temporal resolution and will include land and

marine surface pressure observations calibrated to account for time-varying measurement practices for the period 1893 to present. These data will be extracted from a variety of sources, including the Integrated Surface Hourly land station database, which will be expanded with newly digitized U.S. observations, and newly available data from international partners. These data will be quality controlled and metadata will include estimated errors and corrections for time-varying observation practices.

NWS' National Centers for Environmental Prediction (NCEP) will implement an improved global climate reanalysis system that will be used to quality control upper air data from 1948 to present and bias correct input data to reduce spurious climate trends due to changes in observing systems. NCEP will also assess the effects of changes in the observations to determine the best reanalysis strategy; maintain, improve and implement the climate reanalysis. Finally, NCEP will provide real-time diagnostics to correct problems as they occur, and support the necessary computing infrastructure.

OAR reanalysis activities will extend the current reanalysis period (1948-present) to provide a model reanalysis data set that covers the entire 20th century. This effort will build on reanalysis research indicating that large-scale aspects of climate variability and change can be developed from surface pressure observations using advanced ensemble data assimilation techniques. This historical reanalysis will vastly improve upon existing hand-drawn analyses. This dataset will substantially reduce uncertainty in historical climate variations and improve the analysis and detection of interannual-to-decadal variability and trends in weather and climate in the 20th century. OAR climate attribution research will provide NOAA with a greatly improved capability to interpret causes of observed climate variability and, therefore, will be crucial to serve the climate information needs of policy-makers for explanations of current and evolving regional climate conditions. A major focus will be to develop capabilities to attribute causes of regional climate events, such as major droughts, floods, prolonged warm or cold conditions, climate trends and extremes, and multi-decadal variability.

Initial funding for the Explaining Climate Conditions to Improve Predictions Program is:

- $300,000 to NESDIS/NCDC for three contractors to support production of new quality-controlled data products and long term archive and access to the climate reanalysis suite;
- $700,000 for five NWS Environmental Modeling Center and Climate Prediction Center contractors to establish an infrastructure for the development, maintenance, and distribution of the climate reanalysis suite at NCEP;
- $150,000 for NWS to augment the disk storage to allow for routine production of NWS and OAR reanalysis datasets on the NCEP backup computing facility;
- $450,000 at OAR for four Climate Diagnostics Center affiliated Joint Institute investigators to develop climate attribution products and to construct an historical reanalysis extending from 1893-present; and
- $400,000 for OAR's Office of Global Programs to support extramural research on reanalysis and climate attribution.

Benefits:

- New quality controlled data products for use in the next generation reanalysis;
- Production and dissemination of improved climate reanalysis data products for accurately assessing climate variability, detecting climate change and regional trends in climate extremes;
- Fulfillment of NOAA's commitment to the CCSP goals, and specifically, to deliver the interagency CCSP priority synthesis and assessment products;
- New diagnostic and analysis tools to link the behavior of climate and forcing mechanisms in a physically consistent manner;
- Regular and systematic explanations of past, current, and evolving climate conditions, including the detection and explanation of regional trends and multi-year variability; and
- Enhanced climate prediction capabilities that will enable regional and national decision makers and resource managers to better plan for impacts of climate extremes, variability, and change.

Without the FY 2006 increase, operational re-analysis/analysis of the climate system for improved forecasts of future climate will be delayed. Long-term searchable and accessible archives will also be delayed. Focused climate attribution studies by a science team will not be effectively conducted and operational attribution products explaining current and past climate conditions will not be implemented.

Performance Goals and Measurement Data:

This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Specifically, this increase supports the Climate Performance Goal. These activities provide the foundation for future climate research and are related to the work that will be necessary to achieve the following outcome: "A predictive understanding of the global climate system on time scales of weeks to decades with quantified uncertainties sufficient for making informed and reasoned decisions." By conducting the data reanalysis, NOAA will be better positioned to be able to describe and explain climate variability and change.

Performance Goal: Understanding Climate Variability and Change

PM: Extend climate analyses and reanalyses to included earlier and later time periods	FY06 w/o Incr.	FY06 w/Incr.
Metric: number of years (extended back from present) included in the surface-observation based historical climate reanalysis)	69	81

Regional Integrated Sciences and Assessments (RISA) Program (+0 FTE and $800,000): NOAA requests 0 FTE and an increase of $800,000 for a five-year research effort to refine existing regional integrated research and address new issues of importance to decision-making communities in regions currently served; link, in an integrated manner, climate research and information to decision-making processes in regions not currently supported by NOAA to ensure NOAA is providing effective climate services across the nation; and increase research capacity to address climate-sensitive issues of importance to NOAA's constituents at spatial scales that transcend the current regional foci. This augmentation will aid NOAA in fulfilling its mission goals by supporting research on factors affecting evolving interactions between physical and social environments and associated decision-making needs over a range of temporal and spatial scales.

Background: The RISA program supports eight integrated research teams at the regional level to address complex climate sensitive issues relevant to decision-makers and policy planners. The research team members are based at universities, NOAA Joint Institutes, and government research facilities. The RISA research process has three components: 1) assessments and problem identification, 2) integrated research on issues of concern to end users, and 3) development of information, methodologies, and tools that help expand decision-makers' options. A key component of the RISA program is the integrative nature of the research at a regional scale. The integrative aspects of the research occur across the natural and social sciences to address issues related to water supply, quality, and demand management; crop management and marketing; and wild fire mitigation, control, and recovery.

Proposed Actions:

Existing Team Development and Intra-Regional, Inter-RISA Capacity Development ($500,000). The requested funds will be used to ensure that the core RISA team structures are secure and functional, that intra-regional partnerships are strong within each RISA region, and that emerging needs (e.g. agriculture, human health) that transcend the traditional regional boundaries can be adequately addressed.

The majority of the additional funds will contribute to RISA team development in three ways:

- The refinement of existing integrated research within regions currently served (intra-regional), addressing new regional issues of importance to those decision-making communities. This includes the refinement of validation and verification research to contribute to the emerging issue of effectively transitioning NOAA research results into operational settings. This type of research will aid in the development of the NOAA Climate Transition Program (NCTP) and will support the development of NOAA's climate services.

- Increase the teams' capacity to enhance their assessment and research processes to identify and address emerging climate issues relevant to regional decision-makers (e.g. health, drought, agriculture, water quality). The additional resources will also aid teams to refine their research to a level that will allow them to be better prepared to participate in partnerships with operational entities to transition advanced research products and methodologies into operational settings.
- Increase research capacity to address climate-sensitive issues of importance to NOAA's constituents at spatial scales that transcend the current regional foci (inter-RISA). Examples include water issues that transcend a single political entity such as the Colorado River system and national drought management issues; and Health issues such as West Nile Virus, Hanta Virus, and respiratory ailments. Eighty percent of the U.S. freshwater consumption is in the agricultural sector. This is a significant portion of the total water consumption of the United States. RISA teams working with other parts of NOAA and other federal agencies will contribute to the development of best water management practices for this sector. This integrated research is expected to contribute to reduced regional and national water quantity and quality vulnerabilities while supporting economic development of the agricultural sector in a manner that potentially expands opportunities in other sectors. Such practices require a range of skills that are not always met solely with the talents of individual RISA teams.

Development of New RISA Capacity ($300,000). Not all regional needs are being addressed by the current RISA structure. Additional regional-specific climate information needs require the integrated research methodologies provided by RISA teams. The RISA program is methodically identifying those research needs by conducting a series of scoping workshops across the United States. These workshops are educating regions about the RISA program, assessing regional research capacity, and assessing regional needs for climate information. A portion of the requested augmentation of funds will be utilized to fund a new RISA team in a region that does not currently have such an activity. The process for selecting the new team will be competitive and peer reviewed.

Benefits: The planned research adjustments will contribute to the achievement of NOAA's strategic goals in the following ways:

- It will build on the past achievements of the RISA program to ensure that the benefits of climate and hydrology research are made available to decision-makers in a manner that is relevant and useful to their management processes;
- The validation research will contribute to the successful development of climate services by enhancing NOAA's understanding of what types of research are currently useful to decision-makers and what types of research require modifications based on input by the integration of research and decision-maker input and feedback; and
- NOAA will also advance its ability to conduct integrated research that will have long-term benefits for planning and implementation of the next generation of its research agenda.

These benefits will be realized through the initiation of a new RISA team in a region that demonstrates a demand for applied climate research and refinement of research that will result in improved operational products and policies. The activities of this team are expected to lead to

improvements in wildfire forecasting and response, water systems management, enhanced agricultural management, improved vulnerability assessment and management option development, and continued applied research on climate-related health issues.

Performance Goals and Measurement Data:

This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Specifically, this increase supports the Climate Performance Goal and the GPRA measure, "Improve society's ability to plan and respond to climate variability and change using NOAA climate products and information." The increase will allow NOAA to augment the existing research in this area by focusing the research into areas that are most needed by decision makers.

Performance Goal: Understanding Climate Variability and Change

PM: Initiate new climate research in underrepresented regions of the United States	FY06 w/o Incr.	FY06 w/Incr.
Metric: # of Regional Integrated Science Assessment Programs	8	9

Global Climate Atmospheric Observing System (-0 FTE and -$1,000,000): As a partial offset to the climate increases being proposed in FY 2006, NOAA requests a decrease of $1,000,000 in a lower priority activity. Funding for the global climate atmospheric observing system will be reduced, minimizing NOAA's involvement characterizing aerosols in the Indo-Asian-Pacific region and their subsequent effect on climate radiative forcing.

Subactivity: Climate Research
Line Item: Arctic Research Program

GOAL STATEMENT:

The goals of the Arctic Research Program (ARP) are to 1) achieve an effective climate observing system focused on the U.S. region of the Arctic to allow for regional-scale climate change detection and modeling with useable level of uncertainty; 2) create and analyze Arctic physical and biological data sets designed to detect climate change, validate satellite observations, improve and initialize models, support decision-making; and 3) through partnerships, develop Arctic-wide observing and modeling capability to detect and assess Arctic-wide change and impact, and determine how Arctic processes affect North American and global climate systems.

BASE DESCRIPTION:

Arctic Research Program (ARP): There is clear scientific evidence that a complex suite of seemingly interrelated atmospheric, oceanic and terrestrial changes has occurred in the Arctic in recent decades. The most well known of these changes are general warming, loss of sea ice and glacier mass, thawing of permafrost, and other temperature-related phenomena. These changes affect every part of the Arctic environment and have significant impacts on society.

The ARP is coordinated with other U.S. government agencies through the Study of Environmental Arctic Change (SEARCH) program. The specific role of the ARP is long-term climate observations and analysis of Arctic climate data. For FY 2006, the ARP will continue to focus on four key aspects of the Arctic climate system whose results will improve forecasts of temperature, precipitation, and storms across Alaska and the mainland U.S., and support improvements in forecasting and planning for energy needs, growth seasons, hazardous storm seasons and water resources, as well as provide for better management of Alaskan and Arctic resources.

The first is a project to improve detection of change at the Arctic air/ice/ocean interface that provides data on ice thickness and motion, surface and under-ice water temperatures, and incoming and outgoing radiation. These data will improve estimates of the Earth's radiative balance and Arctic feedbacks on global climate processes through changes in albedo (a measure of reflectivity) and changes in ice volume and movement. These data will also be useful for monitoring the seasonal availability of new and existing northern shipping routes.

The second is a project to improve detection of change in the lower and upper atmosphere by providing data to determine the drivers, intensity and impacts of the Arctic and North Atlantic Oscillations - atmospheric modes that are important in improving climate and weather forecasts. A circum-Arctic network of atmospheric observatories is planned, with the NOAA Barrow Observatory as the prototype.

The third activity involves the aggregation, quality control, and analysis of Arctic environmental data to provide high quality Arctic data sets that include satellite, surface, and radiosonde observations, along with model results, all optimized for the Arctic, to support climate change scenarios, long-term environmental management, energy planning, and possible mitigation of anthropogenic impacts.

The fourth activity recognizes the importance to the U.S. of understanding the relationships between climate change and marine ecosystem change. The Bering Sea and Chukchi Sea lie in areas predicted to undergo rapid and large climate change. This area will serve as a test bed for relating changes in the physical environment to the biological resources in the region, and results here should provide guidance for similar studies in other marine areas.

Base activities support the objective, “Advance understanding and predict changes in the Earth’s environment to meet America’s economic, social, and environmental needs” under the Department of Commerce Strategic Goal of “Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Climate Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Arctic Research Program					
Arctic Research Program	3,637	4,928	3,017	3,017	-
TOTAL	3,637	4,928	3,017	3,017	-
FTE	5	5	5	5	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006:

The following program, or portion thereof, has been terminated in FY 2006: Arctic Research Program ($1,995,000).

Subactivity: Climate Research
Line Item: Other Partnership Programs

GOAL STATEMENT:

The strength of NOAA Research is that it does not operate in isolation but rather in partnership with a multitude of external experts in its fields of research. These partnerships extend to other parts of NOAA; other Federal, state, and local government entities; universities; and industry. The contribution of the unique strengths of each partner greatly enhances the accomplishments of NOAA Research.

BASE DESCRIPTION:

Other Partnership Programs contains various programs appropriated by Congress.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Climate Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Other Partnership Programs					
Central CA Ozone Study	-	247	-	-	-
East Tennessee Ozone Study	297	296	-	-	-
Climate System Research Center	-	739	-	-	-
Inst. for Study of Earth, Oceans & Space (CCRC) (AIRMAP)	(7)	-	-	-	-
Intl Council for Local Environmental Initiatives	-	492	-	-	-
International Pacific Research Center (U of HI)	(8)	-	-	-	-
Climate and Environmental Change	2,473	2,438	-	-	-
Univ of AL Huntsville Climate Research	-	986	-	-	-
Abrupt Climate Change Research	495	487	-	-	-
TOTAL	3,250	5,685	-	-	-
FTE	-	-	-	-	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006:

The following programs, or portions thereof, have been terminated in FY 2006: Central California Ozone Study ($247,000), East Tennessee Ozone Study ($296,000), Climate System Research Center ($739,000), International Council for Local Environmental Initiatives ($492,000), Climate and Environmental Change ($2,438,000), University of Alabama Huntsville Climate Research ($986,000), Abrupt Climate Change Research ($487,000).

Subactivity: Weather and Air Quality Research
Line Item: Laboratories & Joint Institutes

GOAL STATEMENT:

NOAA's Weather and Air Quality Research Programs are conducted towards fulfillment of two goals. First, the programs work to provide the Nation with more accurate and timely warnings and forecasts of: (a) weather events, particularly high-impact weather events that disrupt economic productivity and cause loss of life and property; (b) air quality, particularly ozone and aerosols (particulate matter) that impact human health, damage crops, and affect private sector operational planning for power generation; and (c) solar disturbances and their terrestrial effects, including hazards to satellites and disruptions in communications, navigation, and utility systems. Second, the programs work to provide the scientific basis to develop public policy for air quality.

BASE DESCRIPTION:

The Weather and Air Quality Research objectives for the laboratories and joint institutes are to provide theoretical frameworks, remote sensing technologies, and scientific understanding to: (1) develop and assess new, cost-effective atmospheric observing systems; (2) develop data acquisition, management, analysis, and display systems; (3) develop and verify numerical models and other techniques to provide prediction guidance for all types of weather, particularly high-impact events; and (4) transfer research results to both aid the research community and improve operational warnings and forecasts. Included in the four activities are: daily and extreme weather forecasts; air quality forecasts; space weather forecasts; and crosscuts of weather, air quality, and climate change.

Improved forecasts and warnings require more frequent and higher-density observations, faster communications, and better local data-handling systems. NOAA has implemented a major capital investment that substantially upgrades its ability to collect weather data. In support of this modernization effort, research is needed to improve the spatial and temporal resolution of remote observations of the atmosphere and to integrate the resulting data into descriptions of the atmosphere for use in weather forecasting research and operations. The primary research activities currently include:

- Development of improved atmospheric profiling systems to continuously measure vertical profiles of wind speed and direction, temperature, and humidity using ground and satellite-based remote sensing;
- Development of advanced light detecting and ranging systems and infrared Doppler multi-frequency radars as research tools to improve our knowledge of atmospheric winds, turbulence, aerosols, and moisture processes;
- Development of dual-polarization, phased-array, and multi-frequency Doppler radars and passive radiometers to study convective storms, in order to improve rainfall estimates and to detect damaging winds;
- Improvement of short-range (1-12 hour) forecasting by the development and evaluation of new local data system technologies and techniques;

- Incorporation of satellite-observed wind profile data into forecast models to determine whether the accuracy of weather forecasts is improved;
- Transition hurricane model and forecast decision aide improvements to operations;
- Transition of prototype hourly air quality forecasting capability (i.e., ozone forecast) to operational use; and
- Accelerate improvements in medium range (3-14 day) numerical weather prediction.

Base activities support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Weather and Air Quality Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Laboratories & Joint Institutes					
Laboratories & Joint Institutes	38,533	34,278	35,497	37,197	1,700
TOTAL	38,533	34,278	35,497	37,197	1,700
FTE	211	178	178	178	-

PROGRAM CHANGES FOR FY 2006:

Aeronomy Laboratory: Texas-2006 Regional Air Quality Assessment (+ 0 FTE, +$1,700,000): NOAA requests an increase of 0 FTE and $1,700,000 for an Air Quality regional assessment that will characterize key atmospheric processes that drive air pollution problems in east Texas. The centerpiece of this effort is a comprehensive month-long field experiment that will measure many aspects of weather and air quality. This work is part of a series of assessments that provide both general and region-specific information to air quality decision-makers, including policy-makers at all levels of government, enabling them to develop plans that protect both public health and economic vitality. NOAA's assessments also provide essential information for improving and evaluating numerical models of air pollution that are used to predict unhealthful conditions and evaluate potential policies. The regional assessment will be a collaborative effort among multiple institutions, including NOAA Laboratories (administered by the Aeronomy Laboratory), NOAA Marine and Aircraft Operations, NOAA joint institutes, the U.S. Environmental Protection Agency (EPA), the State of Texas, and university grantees.

Background: More than a third of the U.S. population lives in areas where air pollution levels exceed EPA's health-based standards. It is well known that air pollution, such as ozone and particulate matter, can cause respiratory problems. (This discussion refers to ozone near the ground where it can be inhaled. High concentrations of such low-level ozone can be harmful. This is different from the "beneficial" ozone 30 miles up that shields the surface from ultraviolet radiation). There is now growing evidence that particulate matter, including dust, soot, and sulfates, can also trigger cardiac problems—often leading to premature deaths. The personal and economic consequences to the Nation are enormous (annually, an estimated 40,000 deaths,[1] up to $150B in costs due to air pollution health effects [2], and more than $20B for air pollution controls[3]). As described in its strategic plan, NOAA serves two essential roles in the Nation's response to this problem. The Texas regional assessment supports both of NOAA's roles. First, NOAA serves as an "honest broker," providing objective scientific information to regulatory agencies, regulated parties, and other stakeholders about the causes of unhealthful air pollution—information that is necessary for making well informed decisions that balance society's many interests. The effectiveness of current air quality policies and strategies is, to a large extent, limited by the lack of a quantitative and area-specific understanding of the complex relationships among weather, atmospheric chemistry, and surface exchange that lead to unhealthful air pollution episodes. Its breadth of capability in all areas of atmospheric sciences and the lack of an air quality regulatory role make NOAA uniquely qualified to provide an integrated and trusted view of the atmospheric processes that

control the formation and distribution of air pollution. Second, NOAA and EPA have signed a Memorandum of Agreement to implement an air quality forecasting program that will help communities take measures to protect public health when high pollution levels are expected. NWS is planning to initiate air quality forecasts in phases with expanding geographic coverage, number of pollutants predicted, and length of forecast. OAR is working closely with NWS to ensure that reliable air quality forecast models are available to support these new capabilities.

Proposed Actions: OAR will build on the results of the previously conducted Texas 2000 regional assessment to provide a comprehensive characterization of the key processes that drive air pollution in that region. In particular, NOAA will extend the assessment activities to include a comprehensive study of the sources and processes responsible for the emission, atmospheric formation, growth, and transport of particulate matter (PM). The field study will include detailed measurements of weather and air quality at the surface and aloft. Air quality measurements will include concentrations and composition of particles and precursor species. The FY 2006 funding supports development and field testing of improved observing techniques for PM, preparation for the field study, and initial evaluation of the results. In later years, NOAA will continue to evaluate the results and communicate them to stakeholders. In response to a growing understanding of the relationships between air quality and climate (e.g., particulate matter in the air affects the amount of radiation that reaches and heats the ground), NOAA's air quality and climate programs will jointly conduct this assessment. This allows the information needs of both programs to be cost-effectively satisfied from one field experiment and provides a common dataset for evaluating air quality-climate relationships.

Benefits: This research will provide a comprehensive characterization of the atmospheric processes contributing to air quality problems in the Houston area. This characterization will provide factual information about air quality to decision-makers. Prior studies have generated significant economic and health benefits for the Nation. Discoveries NOAA made in 2000 allowed the State of Texas to develop a less onerous pollution control strategy that still protected public health while also saving the state more than $9B and 64,000 jobs by 2010[4]. Earlier NOAA air quality assessments led to a National Research Council determination that the billions of dollars the Nation was spending to reduce tropospheric ozone levels were ineffectual because they were targeting the wrong precursor chemical. Those results changed the Nation's entire approach to reducing ground-level ozone levels. This activity supports NOAA's Air Quality Program goal to perform a total of 4 regional studies by 2010.

The 2006 regional assessment in Texas will also provide crucial information about atmospheric processes for evaluating and improving NOAA's air quality forecasting capability. The Texas regional assessment will be especially important for understanding processes that control particulate matter formation, transport, and fate, which is essential for creating accurate PM forecast models. Findings from this and future regional assessments are critical in building a foundation of knowledge allowing researchers to expand NOAA's forecasting capability. Without these funds, little or no research will be performed to better understand these processes.

Endnotes:

1 Science (289: 22-23, 2000; 296: 1945-1947, 2002)

2 Cannon, J.S., The Health Costs of Air Pollution: A Survey of Studies Published 1984-1989, American Lung Association,

1990. That report estimated costs of up to $100B in 1988 dollars. The costs were adjusted to 2002 dollars by assuming an inflation rate of 3%.

3 U.S. EPA, "The Benefits and Costs of the Clean Air Act 1990 to 2010," 1999.

4 Tolley, G. and Smith, B. "Cleaning Up Houston's Act: An Economic Evaluation of Alternative Strategies," 2001.

Performance Goals and Measurement Data:

This increase will support the objective, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Specifically, this increase supports the Weather and Water Performance Goal. The following performance measures support the NWS FY06 budget submission for air quality forecast accuracy and timeliness draft targets of 90% and 95% respectively.

Performance Goal: Serve Society's Needs for Weather and Water Information

Performance Measure	2006 w/o Incr.	2006 with Incr.
Increase the cumulative number of comprehensive regional assessments for which field measurements have been collected.	1	2
The number of peer-reviewed articles accepted for publication in a year will meet or exceed the following goals:	13	16
Increase the number of air quality–relevant atmospheric processes that can be characterized in regional field studies.	14	16

TERMINATIONS FOR FY 2006: In FY 2006, the following programs, or portions thereof, are terminated: Laboratories & Joint Institutes ($1,501,000).

Subactivity: Weather and Air Quality Research
Line Item: U.S. Weather Research Program

GOAL STATEMENT:

The overarching goal of the United States Weather Research Program (USWRP) is to accelerate improvement in our forecasting capability for high-impact and routinely disruptive weather--in particular, improvement in forecast timing, location, and specific rainfall amounts associated with hurricane landfall and flood events that significantly affect the lives and property of U.S. inhabitants.

BASE DESCRIPTION:

U.S. Weather Research Program: NOAA proposes to complete the transfer of this program to the NWS in the FY 2006 President's Budget Request.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Weather and Air Quality Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: U.S. Weather Research Program					
U.S. Weather Research Program (USWRP) (THORPEX)	5,175	493	-	-	-
Targeted Wind Sensing	1,895	1,971	-	-	-
Hurricane Research and Model Improvements	-	699	-	-	-
TOTAL	7,070	3,163	-	-	-
FTE	17	-	-	-	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006:

The following program, or portions thereof, has been terminated in FY 2006: Targeted Wind Sensing ($1,971,000), Hurricane Research and Model Improvements ($699,000)

Subactivity: Weather and Air Quality Research
Line Item: Weather & Air Quality Research Programs

GOAL STATEMENT:

The strength of NOAA Research is that it does not operate in isolation but rather in partnership with a multitude of external experts in its fields of research. These partnerships extend to other parts of NOAA; other Federal, state, and local government entities; universities; and industry. The contribution of the unique strengths of each partner greatly enhances the accomplishments of NOAA Research.

BASE DESCRIPTION:

Tornado/Severe Storm Research (Phased-Array Radar): NOAA is developing new technologies for forecasting and detecting tornadoes and other forms of severe weather and to disseminate this information to emergency managers, the media, and the general public for appropriate action. Phased-array radar has the potential to significantly extend lead times for tornadoes and other forms of severe and hazardous weather. Faster scan rates can reduce the time it takes to make a complete Doppler radar observation from six to less than one minute. Coupled with artificial-intelligence-based decision-support systems, tornado lead times could be almost doubled from 12 to 22 minutes.

Major components of this program are continued research support and the construction of and experimentation with a phased-array research testbed at the National Severe Storms Laboratory (NSSL) in Norman, OK. Congress established a joint R&D program for NOAA, DOD, and FAA to investigate the feasibility and benefits of using military phased- array radars for improving severe weather forecast and warning systems. U.S. Navy SPY-1 Phased-Array Radar technology holds considerable promise for making significant improvements to the existing WSR-88D system. Using multiple beams and frequencies, The SPY-1 Phased-Array Radar reduces the scan time for severe weather from six minutes to less than one minute, which can lead to increased lead times for warnings of tornadoes and other forms of hazardous weather. NOAA/NSSL is designated to operate and maintain the equipment, provide facilities, approve associated research, and otherwise assist in all related efforts that may arise.

The Tornado Severe Storm Research (Phased Array Radar) previously housed under Other Partnership Programs, has been moved to this new Weather & Air Quality Research Programs line item.

Base activities support the objective, “Advance understanding and predict changes in the Earth’s environment to meet America’s economic, social, and environmental needs” under the Department of Commerce Strategic Goal of “Observe, protect, and manage the Earth's resources to promote environmental needs.”

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Weather and Air Quality Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Weather & Air Quality Research Programs					
Tornado Severe Storm Research / Phased Array Radar	990	1,971	1,002	1,002	-
TOTAL	990	1,971	1,002	1,002	-
FTE	2	2	2	2	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006:

The following program, or portion thereof, has been terminated in FY 2006: Tornado Severe Storm Research/Phased Array Radar ($1,004,000).

Subactivity: Weather and Air Quality Research
Line Item: Other Partnership Programs

GOAL STATEMENT:

The strength of NOAA Research is that it does not operate in isolation but rather in partnership with a multitude of external experts in its fields of research. These partnerships extend to other parts of NOAA; other Federal, state, and local government entities; universities; and industry. The contribution of the unique strengths of each partner greatly enhances the accomplishments of NOAA Research.

BASE DESCRIPTION:

Other Partnership Programs contains various programs appropriated by Congress.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Weather and Air Quality Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Other Partnership Programs					
NE Center for Atmospheric Science and Policy	-	1,479	-	-	-
New England Air Quality Study	2,968	1,971	-	-	-
Inst. For Study of Earth, Oceans & Space (AirMap - CCRC)	4,919	4,930	-	-	-
Risk Reduction in Water Forecasts (MSU)	-	1,971	-	-	-
Remote Sensing Research (ISU/BCAL)	495	487	-	-	-
STORM (U. of N. Iowa)	487	640	-	-	-
TOTAL	8,869	11,478	-	-	-
FTE	-	-	-	-	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006:

The following programs, or portions thereof, have been terminated in FY 2006: New England Air Quality Study ($1,971,000), New England Center for Atmospheric Science and Policy ($1,479,000), Institute for Study of Earth, Oceans, and Space (AIRMAP - CCRC) ($4,930,000), Risk Reduction in Water Forecasts (MSU) ($1,971,000), Remote Sensing Research (ISU/BCAL) ($487,000), STORM (U. of Northern Iowa) ($640,000).

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: Laboratories & Joint Institutes

GOAL STATEMENT:

NOAA's Ocean, Coastal, and Great Lakes Research programs seek to:

- Provide the research needs to support policy and management decisions for protecting the quality and value of the Nation's marine and coastal resources;
- Increase our understanding of coastal and marine processes for the purpose of predicting the effects of climate change on ecosystems, as well as environmental changes (e.g. invasive species and harmful algal blooms); and
- Provide the technical basis for enhancing the Nation's marine economic sector.

BASE DESCRIPTION:

To be an effective steward of the marine and Great Lakes environments, NOAA relies on state-of-the-art research conducted at in-house laboratories and by external partners. High quality, peer-reviewed research is the basis of sound decision-making. Ocean, Coastal, and Great Lakes Research sub-activities are regularly evaluated by outside experts for quality and relevance to NOAA's management mission. The four OAR laboratories supporting the agency under this subactivity provide long-term research and scientific expertise necessary to meet NOAA's mission. Three partnership programs also support this activity primarily through peer-reviewed proposals to the external research community. These programs are the Sea Grant Program, Ocean Exploration and the National Undersea Research Program.

The three primary objectives for Ocean, Coastal and Great Lakes Research are to: improve the prediction and assessment of ocean, coastal, and Great Lakes processes and phenomena; provide information to promote stewardship of those resources; and explore and understand the 95% of the ocean that is unknown. In support of these objectives, we have identified the following priority research areas:

- Climate Change Effects on Ecosystems
- Sustainable Coastal Development
- Improve Fisheries
- Invasive Species
- Ocean Exploration and Undersea Research

Benefits of our approach:

- NOAA is a science-based agency and has scientists with the expertise to conduct the highest quality research subject to peer-review by outside experts.
- In-house experts provide objective answers and direction to managers and the public.
- Long-term (5-10 year), sustained research investment by NOAA labs and their academic partners leads to agency-specific technology and forecasting models that can not be achieved by either entity separately.

Base activities support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Laboratories & Joint Institutes					
Laboratories & Joint Institutes (ECO)	19,678	19,764	19,576	19,576	-
Laboratories & Joint Institutes (WW)	468	476	497	497	-
Payment to OMAO	99	98	-	-	-
TOTAL	20,245	20,338	20,073	20,073	-
FTE	124	123	123	123	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006: The following programs, or portions thereof, are terminated in FY 2006: Laboratories & Joint Institutes ($737,000), Payment to OMAO ($98,000).

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: National Sea Grant College Program

GOAL STATEMENT:

NOAA's National Sea Grant College Program seeks to:

- Conduct research to enable NOAA to tackle priority problems and opportunities identified by coastal residents and businesses and local, regional, state and Federal agencies.
- Transfer scientific research results to user groups such as natural resource managers and coastal business people.
- Provide training opportunities for K-12 teachers to bring the sciences into the classroom as well as for undergraduate and graduate students to be mentored by senior researchers.
- Inform the public about marine and coastal issues through extension and communications projects.

BASE DESCRIPTION:

Sea Grant is developing a system of regional networks that allows for organizing multi-state responses to regional/ecosystem-level problems. This effort supports a key Ocean Commission recommendation that NOAA move to a regional ecosystem management approach and develop information plans to coordinate ocean and coastal activities in each region. NOAA is in the process of defining regional ecosystem boundaries to implement this recommendation. NOAA will then work with other interested parties to develop information plans and identify priority actions. Sea Grant will be a key tool in this effort. The majority of Sea Grant's resources are currently targeted at the state level. Sea Grant will devote its resources to assist in the development of regional priorities and will support the priority actions identified in the regional information plans. As the regional ecosystems are developed, Sea Grant research, education, extension, and outreach will be targeted at these regions. This new regional focus will enhance Sea Grant's ability to make a critical contribution to this NOAA effort.

Sea Grant Network – This regional effort will be supported by the 30 state Sea Grant programs, located in every coastal and Great Lakes state and Puerto Rico. These programs serve as the core of a dynamic national network of more than 300 participating institutions involving more than 3,000 scientists, engineers, outreach experts, educators and students. The Sea Grant network addresses key issues and opportunities in areas such as aquaculture, aquatic invasive species, coastal community development, estuarine research, fisheries management, coastal hazards, marine biotechnology, marine engineering, seafood safety and water quality. As a non-regulatory program, Sea Grant focuses on generating and disseminating science-based information to a wide range of groups. Some of these include: commercial and recreational fishermen, educators, fish farmers, state and local planning officials, port and harbor commissioners, seafood processors and retailers, and natural resource, water and environmental quality managers.

Research – Sea Grant funds high-quality research that is responsive to user needs, bringing university expertise to bear to solve today's marine environmental problems. Each of the Sea Grant colleges conducts research to solve problems and explore new uses for the world's marine, Great Lakes and coastal resources. This work addresses priority problems and opportunities identified by coastal resource managers and users. As a national network of research institutions, Sea Grant leads the Nation's efforts in the emerging field of marine biotechnology, addressing critical medical, food and environmental concerns.

Education – For three decades, Sea Grant has provided national leadership in enhancing marine literacy for grades K-12 and in developing professionals who understand marine and aquatic science and research. Sea Grant programs offer programs such as summer in-service programs, newsletters, speakers and curriculum materials. By developing innovative science curricula and teacher training programs, and embracing new technologies to enhance learning and pique students' curiosity, Sea Grant helps students understand how relevant science is to their lives. At the university level, Sea Grant recruits and trains undergraduate and graduate students, and employs senior researchers who form a national brain trust for dealing with coastal economic and environmental challenges.

Outreach and Extension – One of Sea Grant's greatest strengths is its ability to help clients use knowledge and research results through a broad multidisciplinary approach to outreach. The results of Sea Grant research are communicated to users at all levels in myriad ways. Outreach education activities for the public and private sectors are conducted through NOAA and: 1) A **communications program** comprised of writers, editors and media specialists who create a variety of printed and electronic information products for many audiences, including the general public; and 2) An **extension program** consisting of an interactive network of about 300 specialists and field agents (mostly university-based), who transfer information and research results to the marine and aquatic community. The overall goal of extension education is to effect change by having individuals, groups or institutions use science-based information.

Technology Transfer – Sea Grant advisory specialists and coastal field agents convey the needs of the marine communities to university scientists, and transfer research results to resource users and managers at the local level. Sea Grant communications specialists package and deliver research, outreach and educational information on a wide range of topics, from fishing vessel safety to coastal erosion, using the full spectrum of modern print, electronic and mass media. Sea Grant organizes and hosts hundreds of scientific and public conferences and workshops each year on topics including: zebra mussels and other invasive species, commercial fishing, seafood processing, autonomous underwater vehicles and offshore structures.

Program Evaluation – Sea Grant has implemented a rigorous four-year external performance review process for its federally sponsored university-based state programs, utilizing exacting criteria and benchmarks developed with the help of outside experts. Performance review teams are comprised of highly experienced, distinguished, knowledgeable individuals and performance is judged quantitatively against performance benchmarks and metrics. Foremost among these benchmarks is a program's impact on mission and programmatic objectives as well as its connection with users of science-based information. Individual program performance is used to determine merit-based funding for each of the state programs.

Benefits:

- The stability of partnerships between NOAA and the Sea Grant institutions allows the Agency to address long-term programmatic goals and develop constituent relationships and local leadership nationwide.
- Having local management in place ensures NOAA's investment flows to the highest local priorities, bringing the most appropriate university resources to bear on these problems.
- Sea Grant's extension and outreach infrastructure enables rapid transfer of objective information to users, timely identification of emerging issues and a forum to engage local constituencies in policy and priority setting.
- Sea Grant can and does reach, literally, millions of people through its communication, education and extension networks. In a world where public awareness and knowledge of the environment will be increasingly critical to public policy, Sea Grant capabilities play an important role for the Agency in transferring objective information to a diverse, nationwide audience.
- Sea Grant plays a unique and important role in advancing our national interest in marine resources. Together with the Office of Naval Research (ONR) and the National Science Foundation (NSF), Sea Grant and other NOAA programs provide the only sustained Federal contact and funding source for universities with marine research capabilities. Sea Grant provides a regional and national research focus while supporting marine and coastal resource research of immediate public importance and application. It is virtually the only source of funding in the United States for marine policy studies.
- By employing the expertise and skills of the network's universities, research institutions and programs, Sea Grant activities have spurred economic growth and cost savings, created new products and services, enhanced coastal and marine resource management, reduced the loss of life and property, and educated tens of thousands of K-12 and university students.

Base activities support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: National Sea Grant College Program					
National Sea Grant College Program Base (Base)	61,948	57,169	61,208	61,208	-
Aquatic Nuisance Species/Zebra Mussel Research	-	986	-	-	-
Gulf of Mexico Oyster Initiative	-	986	-	-	-
Marine Invasive Species Program	-	247	-	-	-
Oyster Disease Research	-	986	-	-	-
Fisheries Extension/Outreach Program (Sea Grant)	-	1,478	-	-	-
TOTAL	61,948	61,852	61,208	61,208	-
FTE	17	23	23	23	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006: The following program, or portion thereof, is terminated in FY 2006: National Sea Grant College Program ($719,000).

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: National Undersea Research Program (NURP)

GOAL STATEMENT:

NOAA's National Undersea Research Program (NURP) seeks to:

- Promote healthy coasts and effective management;
- Foster stewardship of the ocean's resources;
- Promote discovery via hypothesis driven research;
- Develop appropriate technologies for undersea research; and
- Develop innovative education & outreach efforts through partners

BASE DESCRIPTION:

The mission of the NURP is to increase knowledge essential for the wise use of oceanic, coastal, and large lake resources through advanced undersea research. NURP is a comprehensive underwater research program that places scientists underwater, either directly through the use of submersibles, underwater laboratories, and wet diving, or indirectly by using remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), and observatories. The *in situ* approach allows acquisition of otherwise unobtainable observations, samples, and experimentation related to the Nation's, NOAA's, and regional priority research needs. NURP pioneers new techniques and technologies and identifies emerging issues for operational programs.

NURP is primarily a grants and infrastructure program with most of its funding going to the extramural research community, primarily academia. NURP-supported research is peer-reviewed by outside experts and the highest priority is given to proposals for studies in the United States, its large lakes, territorial seas, and adjacent waters. Through ownership or leasing, NURP provides undersea systems that work from the coast to the deep sea.

Benefits:

- NURP owns and operates the Aquarius, the world's only underwater science laboratory, located off Key Largo, Florida, in a national marine sanctuary. Aquanauts live on and study sensitive coral reef ecosystems threatened by natural and human-caused impacts and are able to perform studies not possible through traditional diving techniques.
- NURP operates undersea ROVs and AUVs that are independent of the surface, battery powered, and controlled by computers that are deployed from ships of opportunity.

- NURP scientists explore the deep ocean-depths of up to 4,500 meters (15,000 feet) through research submarines including the Johnson Sea-Link, Delta, Alvin, and Pisces V. NURP serves as the lead office for fulfilling NOAA's statutory responsibility to improve the safety and performance of civilian divers.

Research:

Promote healthy coasts and effective management - Driven by concern for the health and conservation of marine ecosystems and resources, certain marine and coastal areas are of particular concern (e.g., coral reefs, marine protected areas, marine sanctuaries) and in need of undersea research. NURP supports research to understand the effects of anthropogenic stressors on processes that affect specific life stages of marine organisms and assesses the physical and biological impacts of natural and anthropogenic-related disasters (e.g., hurricanes, tsunami, flood plumes, pollutant spills), and develop methods to evaluate the economic costs of destruction and recovery.

Foster stewardship of the ocean's resources - NURP supports NOAA's National Marine Fisheries Service responsibilities to improve Federal and state abilities to effectively manage and restore fisheries by: developing and employing advanced technology to research stock assessments of mammals, fish and invertebrates; mapping Essential Fish Habitat; and assessing damage from mobile fishing gear.

Develop appropriate technologies for undersea research - The changing and difficult study of the ocean realm requires new intellectual approaches and a national investment in a new mode of conducting undersea investigations. New approaches, such as seafloor observatories, greatly enhance traditional capabilities by providing invaluable long-term monitoring and continuity of observations. NURP is engaged in developing new technologies as well as ensuring a sustained undersea observing system.

Base activities support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: National Undersea Research Program (NURP)					
National Undersea Research Program (NURP)	11,866	12,321	10,464	10,464	-
National Institute for Undersea Science and Technology	4,948	4,928	-	-	-
TOTAL	16,814	17,249	10,464	10,464	-
FTE	6	6	6	6	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006: The following programs, or portions thereof, are terminated in FY 2006: National Undersea Research Program ($1,884,000); National Institute for Undersea Science and Technology ($4,928,000).

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: Ocean Exploration

GOAL STATEMENT:

This activity is NOAA's multi-line office (OAR/NOS/NMFS) investment in undersea exploration, science, and technology in both the Deep Ocean and areas of special concern, such as the U.S. Exclusive Economic Zone (EEZ) and National Marine Sanctuaries (NMS). The program integrates existing NOAA programs and external academic, federal, and commercial participants to increase our knowledge of the ocean realm to support NOAA's goal of Ecosystem Management.

BASE DESCRIPTION:

This program seeks to increase our national understanding of ocean systems and processes through partnerships in 6 or more major voyages of discovery. It uses ten percent of all funds for education and outreach to improve ocean literacy in America and to inform America's school children and stimulate their interest in ocean science. The data and information from these cruises are made available to all researchers and the general public on our award winning website **www.oceanexplorer.noaa.gov**. The program spends approximately seventy percent of its funds outside of the agency on science that benefits NOAA's understanding of the oceans and ecosystems. In FY 2005, a portion of the increased OE base funded a remotely operated vehicle (ROV) and other infrastructure for the new Exploration vessel scheduled for sea trials in FY 2007. With this infrastructure complete, base funds requested for FY 2006 will support more expeditions that are selected through a peer-reviewed process. The number and length of expeditions will follow the recommendations of a National Academy of Sciences study on exploration expected to be finished in early FY 2006.

Exploration focuses on four key goals as defined by multiple national advisory panels:

Explore unknown and poorly known areas of the ocean: Exploration science returns to areas that may have been visited with outdated technology in order to refine our understanding of what resources and processes are in the oceans. The oceans potentially hold a vast untapped economic potential. The wealth of living and non-living resources yet to be discovered may provide new opportunities for medical science, specifically pharmaceutical applications. For example, microbial organisms that thrive in deep-sea vents have been determined to have significant biomedical potential.

Ocean Mapping: Less than ten percent of the US EEZ has been mapped with current technology, and many resources, habitats, and features remain undiscovered. Our ability to manage by ecosystems is necessarily dependent upon defining those ecosystems completely. In conjunction with other NOAA mapping efforts, ocean exploration routinely maps ocean habitat during an expedition to discover and record the physical, biological, geological, archaeological, and chemical nature of the oceans.

New Technology: Advancing knowledge requires new technology including data collection. The Ocean Exploration Program invests in new technologies for ocean discovery. The program coordinates new technology needs and investments with other NOAA programs and other federal agencies through the National Ocean Partnership Program (NOPP). For FY06, the program's technology focus is on the use of autonomous platforms and vehicles to meet NOAA's data needs, the role for industry in exploring the ocean, and new and emerging sensor technologies.

Education and Outreach: The program allocates at least ten percent of funding to expanding public awareness and knowledge of oceans in order to increase ocean literacy and stewardship. The program website is rated in the top five worldwide, by a major international science education authority. This website is visited by over 5,000 people per day and contains thousands of pages of detailed information about our recent discoveries. It includes teaching materials for educators, daily logs of expeditions, immediate results of the discoveries as they happen, and new real-time satellite technology to bring students and scientific experts to the undersea from any remote computer.

Benefits: NOAA's Ocean Exploration program is a national program, providing the opportunity of discovery to scientists in academia, federal agencies, and commercial sector. No other dedicated source of funding or logistics is found for discovery-based science. Limits in undersea technology and exploratory funding have kept the ocean frontier beyond reach and this program seeks to reduce and eventually eliminate that barrier. While the economic and social benefits of anticipated discovery are potentially significant the promise of discovery is clear; wherever the program has looked, new discoveries and information are found.

NOAA programs benefit from new sources and scales of information generated from this program:

- Greater knowledge of living marine resources, their habitats, and ecosystems enhances fisheries and ocean stewardship.
- Comprehensive site surveys and inventories inform NOAA's National Marine Sanctuaries management.
- Characterization of the EEZ improves habitat and marine resource management.
- Inventories our Nation's and other submerged cultural and historic resources are significantly increased.

The Exploration program also provides support to the international Census of Marine Life for governance and scientific investigation.

Base activities support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Ocean Exploration					
NMNH East Wing (Ocean)	15,832	4,928	-	-	-
Ocean Exploration	12,920	22,670	22,693	22,693	-
Submersible Microtechnology Research	983	969	-	-	-
TOTAL	29,735	28,567	22,693	22,693	-
FTE	9	11	11	11	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006: The following programs, or portions thereof, are terminated in FY 2006: NMNH East Wing (Oceans) ($4,928,000), Ocean Exploration ($56,000), and Submersible Microtechnology Research ($969,000).

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: Other Ecosystems Programs

GOAL STATEMENT:

In addition to supporting its individual Ocean, Coastal, and Great Lakes Research laboratories, NOAA Research also seeks to initiate and maintain research and development programs that cut across its own intramural foundation as well as other NOAA ecosystem research and service programs and the university community in an effort to advance the cutting edge of NOAA research capabilities.

BASE DESCRIPTION:

NOAA Aquatic Invasive Species (AIS) Program: Invasive species are one of the two greatest threats to endangered species (second only to habitat loss), and they have been responsible for some of the most dramatic fishery losses in recent times (e.g., Lake trout, turbot, whitefish, salmon in Great Lakes). Hundreds of millions of dollars are spent each year to mitigate the effects of non-indigenous aquatic species in our coastal and Great Lakes ecosystems, and to prevent new invasions from occurring. This program focuses on the prevention and control of invasive species. Control activities include eradication, population reduction, preventing further spread, and/or mitigating the impact of invasive species on user groups. The Non-Indigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990 gave the Department of Commerce broad responsibility for reducing the impact of aquatic species invasions, including controlling established aquatic nuisance species to minimize the risk of harm to the environment and public health and welfare.

NOAA Marine Aquaculture Program: NOAA's Aquaculture Competitive Grants Program funds external partners to expand regional efforts in developing new species for aquaculture; test new production systems under actual field conditions; improve and clarify the regulatory framework and coastal zoning for aquaculture; support hatchery development technology; conduct research on the environmental impacts of aquaculture; provide the regulatory, environmental, developmental, and scientific base for the U.S. aquaculture industry; and support research in genetics, disease diagnosis and control, nutrition, hormonal manipulation, and biotechnology. The program promotes an environmentally friendly and profitable aquaculture industry that will alleviate stress on natural fish stocks, create jobs, provide healthy protein to Americans at a reasonable cost, improve food safety and address our Nation's trade deficit.

Base activities support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA
(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Other Ecosystems Programs					
Aquatic Invasive Species Program	-	-	-	2,502	2,502
Marine Aquaculture Program	761	-	-	1,622	1,622
Environmental Literacy Program	-	-	-	-	-
TOTAL	761	-	-	4,124	4,124
FTE	2	-	-	3	3

PROGRAM CHANGES FOR FY 2006:

Aquatic Invasive Species (AIS) Program (+2 FTE and +$2,502,000): NOAA requests an increase of 2 FTE and $2,502,000 for its Aquatic Invasive Species Program. This will restore the base program that was not funded in FY 2005 as well as enhance the program with critically needed funds to accomplish this important NOAA and national mission. The initiative focuses on protecting coastal aquatic resources from the serious and increasing challenges of invasive species. The NOAA AIS Program is part of a crosscut budget initiative involving eight other Federal agencies and is a cooperative effort between NOAA Research, National Ocean Service, and National Marine Fisheries Service. This augmentation represents a strategic decision by NOAA to develop the critical mass to remedy a growing worldwide threat. The Department of Commerce also supports the interagency Aquatic Nuisance Species Task Force and National Invasive Species Council. NOAA co-chairs both of these policy bodies.

Background: Millions of dollars are spent each year to mitigate the effects of aquatic invasive species that have invaded all coastal and Great Lakes ecosystems and to prevent new invasions. For example, the cost associated with the zebra mussel introduction is over $200 million each year. The European Green Crab threatens the vitality and economic productivity of U.S. marine ecosystems at an estimated cost of more than $44 million annually from lost shellfish and crabs that are consumed by the green crab. Aquatic invasive species disrupt the stability of coastal ecosystems, thereby affecting beneficial recreational, economic, and other uses of coastal resources. They constitute one of the largest present and future threats to coastal ecosystems, coastal economies, protected habitats and species, and human health in coastal regions.

NISA identifies the need for early detection and monitoring of aquatic invasive species and mandates that NOAA, in conjunction with other Federal agencies, develop a comprehensive national program. Reliable and comparable monitoring of coastal ecosystems based on standardized protocols is

essential for the early detection of introduced species. Besides enabling a rapid response to new introductions, the collected monitoring data will elucidate factors that facilitate invasions, rates of spread, and impacts of invasive species on coastal ecosystems. These activities are also mandated in NISA.

Proposed Actions:

Of the requested increase for NOAA's Invasive Species Program, $1,479,000 and 2 FTE will allow NOAA to: (1) continue to implement the national program to finalize standardized survey methods and sampling protocols, (2) add another region to the Early Warning System for Aquatic Invasive Species Introduction, and (3) complete one additional aquatic species baseline assessment. The remaining $1,000,000 and 1 FTE will be used to enhance activities, administered through NMFS, for control of established populations of species determined to be high priorities. In the outyears, this item will include research for the development of new control technologies. In addition, the program will continue to be coordinated with AIS efforts in the National Sea Grant College Program, in other NOAA programs, and in the academic community.

Benefits:

- An AIS program that is responsive to legal mandates and the most urgent national needs related to the growing AIS problem;
- Legislative prevention mandates partially met; increased number of pathways and high risk species identified and effective approaches developed to reduce invasion risk to NOAA steward resources;
- One or more ballast water treatment technologies and management approaches verified and available for use;
- Other pathways reduced or interdicted through targeted risk reduction actions, education, and increased public awareness and participation;
- Increased ability to detect new AIS invasions early enough to allow targeted rapid response;
- Availability of management information to control invasive species, such as life history parameters, potential range, and possible pathways for spread; and
- Development of new control technologies, which will reduce the economic and environmental costs of highly invasive species.

Failure to fund the Aquatic Invasive Species Program will stop control activities, development of new control technologies, and existing monitoring of standardized survey methods and sampling protocols use to complete additional aquatic species baseline assessment.

Performance Goals and Measurement Data: This increase will support the objective, "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs." Specifically, this increase supports the Ecosystem-Based Management Performance Goal.

Performance Goal: Ecosystem-Based Management

PERFORMANCE MEASURE for Monitoring and Control	2006 w/o Incr.	2006 w/Incr.
Number of ecosystems for which baseline invasive species assessments are completed (cumulative)	0	2
Number of ecosystems for which Early Warning Systems are capable of verifying potentially invasive species within two weeks of detection (cumulative)	0	2
Completion of pilot National Early Warning System, using protocols and effectiveness measures developed and proven in regional pilots*	0%	0%*
Top priority green crab control measures implemented	0%	100%
Number of additional invasive species populations eradicated, contained, or mitigated (cumulative)	0	6

*Note: With the initiative, this system will be completed in FY 2008.

NOAA Marine Aquaculture Program: (+1 FTE, +$1,622,000): NOAA requests an increase of 1 FTE and $1,622,000 to restore its cutting-edge research operations and activities in aquaculture. The aquaculture funds will be used to run NOAA's annual national competition to develop new offshore aquaculture research, enhance wild fisheries stock programs, and develop and transfer re-circulating aquaculture systems to an operational mode. The increase will strengthen aquaculture research in three of the five regions where partnerships between NOAA and the external community have already been established. NOAA's aquaculture education and extension network will be maintained, facilitating the transfer of research into business operations as well as informing the public and practitioners about key issues and information related to aquaculture. In FY2004, NOAA received 134 high quality aquaculture proposals. This increase will cover the highest-priority research proposals that include multiple NOAA partners.

Background: The United States faces a "seafood deficit" amounting to $7 billion annually. We import more than 60 percent of the fish and shellfish we consume. Marine aquaculture has the potential to provide up to 25 percent of our seafood within the next 20 years and provides the seed for rebuilding some fishery stocks. The NOAA Marine Aquaculture Program will be at the forefront of efforts to grow the U.S. marine aquaculture industry through an integrated program of research, education, and technology transfer that is focused on key scientific, engineering, environmental, and socioeconomic issues that currently inhibit this emerging industry.

Benefits: The NOAA Marine Aquaculture Program is poised to:

- Offset the current $7 billion annual U.S. trade deficit in seafood through increased domestic production from marine aquaculture;
- Rebuild wild fisheries stocks through enhancement programs, as well as harvesting pressures;
- Ensure the sustainability of marine aquaculture; and

- Spur job creation in both the production and processing of fishery products, thereby revitalizing fishing communities devastated by collapsing fisheries industries.

Performance Goals and Measurement Data: Performance measures for aquaculture research center around: (1) technology development (transitioning offshore cage technology and recirculating systems to an operational mode) and (2) increasing the number of fish species under cultivation (from 5 currently to 11 within five years). Failure to adequately fund NOAA's development of environmentally sound and ecosystem-based methods for aquaculture will put our neareshore environment at risk and will result in far less effective and efficient methodologies for responding to enviornmental risks that plaque aquaculture industries of other countires as well as more primative efforts in this country.

Subactivity: Ocean, Coastal, and Great Lakes Research
Line Item: Other Partnership Programs

GOAL STATEMENT:

NOAA's Ocean, Coastal, and Great Lakes Research Other Partnership Programs seek to: (1) provide information needed to support policy and management decisions for protecting the quality and value of the Nation's marine and coastal resources; (2) increase our understanding of coastal and marine processes for the purpose of predicting environmental changes; and (3) provide the technical basis for enhancing the Nation's marine economic sector.

BASE DESCRIPTION:

Other Partnership Programs contains various programs appropriated by Congress.

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Ocean, Coastal, and Great Lakes Research	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: Other Partnership Programs					
Aquatic Ecosystems - Canaan Valley Institute	2,562	4,239	-	-	-
Institute for Science Technology and Public Policy	965	887	-	-	-
Atmospheric Dispersion Forecasting / Jackson State Univ	-	986	-	-	-
Great Lakes Toxicity	495	488	-	-	-
Gulf of Maine Council	989	739	-	-	-
Lake Champlain Research Consortium	248	345	-	-	-
NISA/Ballast Water Demonstrations	3,431	3,450	-	-	-
NISA/Alaska	1,286	1,479	-	-	-
New Hampshire Milfoil	581	-	-	-	-
Ocean Health Initiative	9,894	-	-	-	-
Cooperative Institute for New England Mariculture and Fisheries	2,914	2,957	-	-	-
NH Center for the Study of Lakes and Ecosystems	-	492	-	-	-
Cooperative Sensor Development Lab for Oceans & Climate	495	492	-	-	-
Aquaculture Education Program - Cedar Point MS	(186)	1,774	-	-	-
Pacific Tropical Ornamental Fish	479	492	-	-	-
Aquaculture Management Plan - RICRMC	(31)	-	-	-	-
Tsunami Hazard Mitigation	(11)	-	-	-	-
TOTAL	24,111	18,820	-	-	-
FTE	-	-	-	-	-

PROGRAM CHANGES FOR FY 2006:

None.

TERMINATIONS FOR FY 2006: The following programs, or portions thereof, have been terminated in FY 2006: Aquatic Ecosystems - Canaan Valley Institute ($4,239,000), Institute for Science, Technology, and Public Policy ($887,000), Atmospheric Dispersion Forecasting / Jackson State University ($986,000), Great Lakes Toxicity ($488,000), Gulf of Maine Council ($739,000), Lake Champlain Research Consortium ($345,000), NISA/Ballast Water Demonstrations ($3,450,000), NISA Alaska ($1,479,000), Cooperative Institute for New England Mariculture and Fisheries ($2,957,000), NH Center for the Study of Lakes and Ecosystems ($492,000), Cooperative Sensor Development Lab for Oceans and Climate ($492,000), Aquaculture Education Program - Cedar Point, MS ($1,774,000), and Pacific Tropical Ornamental Fish ($492,000)

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Subactivity: Information Technology, R&D, and Science Education
Line Item: High Performance

GOAL STATEMENT:

NOAA's Information Technology R&D and Science Education program seeks to make major improvements in NOAA's ability to forecast the weather and climate, and disseminate environmental information. It also seeks to stimulate the modernization of NOAA's computationally intensive services through the use of evolving high performance computing technologies (HPCC). The Educational Partnership Program for Minority Serving Institutions strengthens NOAA's partnerships with Minority Serving Institutions (MSIs).

BASE DESCRIPTION:

High-Performance Computing and Communication: Through this program, NOAA participates as a "mission" agency in the Federal Networking and Information Technology Research and Development initiative as it has evolved from the High Performance Computing and Communications Initiative. NOAA has a need for high-performance computing and high-speed networking to perform its mission; and, through participation in this initiative, NOAA contributes to the overall goals of the Federal initiative. The Procurement, Acquisition and Construction (PAC) account also carries funding under this program providing NOAA with modern high-performance computing systems required to support NOAA's advanced computing research needs. Improvements in the accuracy and timeliness of NOAA's short-term weather warnings, seasonal forecasts, and regional and global climate predictions are heavily dependent on major advances in high-end computing power and the widespread availability of environmental data and information. Timely and responsive dissemination of NOAA's services and information requires full use of modern network, communication, and information technologies. The HPCC primarily serves the NOAA Strategic Goal of: "Serve Society's Needs for Weather and Water Information."

Educational Partnership Program with Minority Serving Institutions (EPP/MSI): The EPP/MSI program supports NOAA's Environmental Literacy, Outreach and Education crosscutting priority in NOAA's Strategic Plan. In support of this priority, NOAA has made a commitment to expand and strengthen its partnerships with MSIs. The Educational Partnership Program's mission is to increase training and research collaboration and career opportunities for individuals in NOAA-related professions. The program's goal is to provide financial support and encourage students to pursue research and education in atmospheric, oceanic, and environmental sciences and remote sensing programs. NOAA's EPP/MSI consists of four programmatic components: Cooperative Science Centers, the Environmental Entrepreneurship Program, the Graduate Sciences Program, and the Undergraduate Scholarship Program.

Base activities support the objectives, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" and "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Information Technology, R&D, and Science Education	FY 2004 ACTUALS	FY 2005 CURRENTLY AVAILABLE	FY 2006 BASE PROGRAM	FY 2006 ESTIMATE	INCREASE / DECREASE
Line Item: High Performance					
High Performance (WW)	12,700	12,322	12,723	12,949	226
Educational Partnership Program/Minority Serving Institutions (EPPMSI)	-	16,757	14,407	14,407	-
TOTAL	12,700	29,079	27,130	27,356	226
FTE	18	13	13	13	-

PROGRAM CHANGES FOR FY 2006:

High-Performance Computing and Communication (+0FTE and +$226,000): NOAA requests an increase of 0 FTE and $226,000 to restore funds requested in FY 2005.

Performance Goals and Measurement Data:

This increase will support the objective: "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the DOC Strategic Goal of 'Observe, protect, and manage the Earth's resources to promote environmental needs'. Specifically, this increase supports NOAA's Weather & Water strategic goal.

Performance Measure	2006 w/o Incr.	2006 Est.
Determine the national explained variance (%) for temperature for the contiguous U.S. using USCRN stations	96.7%	>97%
Determine the national explained variance (%) for precipitation for the contiguous U.S. using USCRN stations	90%	91.2%

TERMINATIONS FOR FY 2006:

The following programs, or portions thereof, have been terminated for FY 2006: Educational Partnership Program/Minority Serving Institutions ($2,350,000).

Exhibit 13

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
Contribution to the NOAA Strategic Planning Goals and Objectives
(Dollar amounts in thousands)

Oceanic and Atmospheric Research	FY 2004 Actuals		FY 2005 Currently Available		FY 2006 Base Program		FY 2006 Estimate		Inc/Dec from Base	
	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Climate										
Climate	336	168,161	316	173,828	315	156,242	326	174,276	11	18,034
Total C	336	168,161	316	173,828	315	156,242	326	174,276	11	18,034
Ecosystems										
Ecosystems	154	153,157	159	146,350	159	113,941	162	118,065	3	4,124
Total ECO	154	153,157	159	146,350	159	113,941	162	118,065	3	4,124
Mission Support										
Mission Support	6	1,700	20	18,531	20	16,252	20	16,252	-	-
Total OE	6	1,700	20	18,531	20	16,252	20	16,252	-	-
Weather and Water										
Weather and Water	258	70,299	203	65,397	203	51,188	203	53,114	-	1,926
Total WW	258	70,299	203	65,397	203	51,188	203	53,114	-	1,926
Total Oceanic and Atmospheric Research	754	393,317	698	404,106	697	337,623	711	361,707	14	24,084

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Exhibit 10

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research		FY 2004 Actuals Personnel	FY 2004 Actuals Amount	FY 2005 Currently Available Personnel	FY 2005 Currently Available Amount	FY 2006 Base Program Personnel	FY 2006 Base Program Amount	FY 2006 Estimate Personnel	FY 2006 Estimate Amount	Inc/Dec from Base Personnel	Inc/Dec from Base Amount
Climate Research											
Laboratories & Joint Institutes	Pos/BA	263	47,246	260	46,047	259	47,941	259	47,941	-	-
	FTE/OBL	252	47,227	250	46,717	249	47,941	249	47,941	-	-
Climate & Global Change Program	Pos/BA	81	69,659	69	67,517	69	57,405	69	57,405	-	-
	FTE/OBL	58	67,669	67	67,528	67	57,405	67	57,405	-	-
Climate Observations & Services	Pos/BA	34	47,749	21	53,134	21	51,193	35	69,227	14	18,034
	FTE/OBL	33	50,015	20	53,438	20	51,193	31	69,227	11	18,034
Arctic Research Program	Pos/BA	5	3,637	5	4,928	5	3,017	5	3,017	-	-
	FTE/OBL	5	3,612	5	4,985	5	3,017	5	3,017	-	-
Other Partnership Programs	Pos/BA	-	3,250	-	5,685	-	-	-	-	-	-
	FTE/OBL	-	3,290	-	5,685	-	-	-	-	-	-
Total Climate Research	Pos/BA	383	171,541	355	177,311	354	159,556	368	177,590	14	18,034
	FTE/OBL	348	171,813	342	178,353	341	159,556	352	177,590	11	18,034
Weather and Air Quality Research											
Laboratories & Joint Institutes	Pos/BA	236	38,533	182	34,278	182	35,497	182	37,197	-	1,700
	FTE/OBL	211	38,601	178	34,613	178	35,497	178	37,197	-	1,700
U.S. Weather Research Program	Pos/BA	16	7,070	-	3,163	-	-	-	-	-	-
	FTE/OBL	17	7,400	-	3,196	-	-	-	-	-	-

Exhibit 10

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Weather & Air Quality Research	Pos/BA	3	990	3	1,971	3	1,002	3	1,002	-	-
Programs	FTE/OBL	2	990	2	1,971	2	1,002	2	1,002	-	-
Other Partnership Programs	Pos/BA	-	8,869	-	11,478	-	-	-	-	-	-
	FTE/OBL	-	8,955	-	11,478	-	-	-	-	-	-
Total Weather and Air Quality	Pos/BA	255	55,462	185	50,890	185	36,499	185	38,199	-	1,700
Research	FTE/OBL	230	55,946	180	51,258	180	36,499	180	38,199	-	1,700
Ocean, Coastal, and Great Lakes Research											
Laboratories & Joint Institutes	Pos/BA	127	20,245	127	20,338	127	20,073	127	20,073	-	-
	FTE/OBL	124	20,063	123	20,604	123	20,073	123	20,073	-	-
National Sea Grant College	Pos/BA	25	61,948	25	61,852	25	61,208	25	61,208	-	-
Program	FTE/OBL	17	61,484	23	62,476	23	61,208	23	61,208	-	-
National Undersea Research	Pos/BA	6	16,814	6	17,249	6	10,464	6	10,464	-	-
Program (NURP)	FTE/OBL	6	16,697	6	17,382	6	10,464	6	10,464	-	-
Ocean Exploration	Pos/BA	14	29,735	14	28,567	14	22,693	14	22,693	-	-
	FTE/OBL	9	30,044	11	28,821	11	22,693	11	22,693	-	-
Other Ecosystems Programs	Pos/BA	2	761	-	-	-	-	4	4,124	4	4,124
	FTE/OBL	2	859	-	-	-	-	3	4,124	3	4,124
Other Partnership Programs	Pos/BA	-	24,111	-	18,820	-	-	-	-	-	-
	FTE/OBL	-	36,201	-	19,006	-	-	-	-	-	-
Total Ocean, Coastal, and Great	Pos/BA	174	153,614	172	146,826	172	114,438	176	118,562	4	4,124
Lakes Research	FTE/OBL	158	165,348	163	148,289	163	114,438	166	118,562	3	4,124

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Information Technology, R&D, and Science Education											
High Performance	Pos/BA	15	12,700	15	29,079	15	27,130	15	27,356	-	226
	FTE/OBL	18	12,902	13	29,112	13	27,130	13	27,356	-	226
Total Information Technology, R&D, and Science Education	Pos/BA	15	12,700	15	29,079	15	27,130	15	27,356	-	226
	FTE/OBL	18	12,902	13	29,112	13	27,130	13	27,356	-	226

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Exhibit 14

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Oceanic and Atmospheric Research
Subactivity: Climate Research

Title		Grade	Number	Annual Salary	Total Salaries
Research Scientist	Boulder, CO	ZP-V	2	115,000	230,000
Research Scientist	Boulder, CO	ZP-IV	5	90,000	450,000
Research Scientist	Boulder, CO	ZP-III	4	60,000	240,000
Research Scientist	Silver Spring, MD	ZP-IV	1	90,000	90,000
Research Scientist	Silver Spring, MD	ZP-IV	1	90,000	90,000
Research Scientist	Silver Spring, MD	ZP-V	1	115,000	115,000
Total			14		1,215,000
Less Lapse	25%		2		(303,750)
2005 Pay Adjustment (3.5%)					31,894
2006 Pay Adjustment (2.3%)					21,692
Total					964,836

Personnel Data	Number
Full-time permanent	11
Other than full-time permanent	0
Total	11
Authorized Positions	
Full-time permanent	14
Other than full-time permanent	0
Total	14

Exhibit 14

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Oceanic and Atmospheric Research
Subactivity: Ocean, Coastal, and Great Lakes Research

Title		Grade	Number	Annual Salary	Total Salaries
Fisheries Biologist	Silver Spring, MD	ZP-V	1	115,000	115,000
Fisheries Biologist	Silver Spring, MD	ZP-III	2	60,000	120,000
Fisheries Biologist	Silver Spring, MD	ZP-IV	1	90,000	90,000
Total			4		325,000
Less Lapse	25%		2		(81,250)
2005 Pay Adjustment (3.5%)					8,531
2006 Pay Adjustment (2.3%)					5,802
Total					258,084

Personnel Data	Number
Full-time permanent	4
Other than full-time permanent	0
Total	4
Authorized Positions	
Full-time permanent	3
Other than full-time permanent	0
Total	3

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Climate Research

	Object Class	2006 Increase
11	Personnel compensation	
11.1	Full-time permanent	965
11.9	Total personnel compensation	965
12.1	Civilian personnel benefits	246
21	Travel and transportation of persons	429
22	Transportation of things	28
23.3	Communications, utilities and miscellaneous charges	1,255
24	Printing and reproduction	28
25.2	Other services	5,707
25.3	Other purchases of goods and services from Govt accounts	1,461
25.5	Research and development contracts	18
26	Supplies and materials	500
31	Equipment	653
41	Grants, subsides and contributions	7,744
99	Total Obligations	19,034

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Climate Research

	Object Class	2006 Decrease
41	Grants, subsides and contributions	(1,000)
99	Total Obligations	(1,000)

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Weather and Air Quality Research

	Object Class	2006 Increase
25.2	Other Services	180
31	Equipment	600
41	Grants, subsides and contributions	920
99	Total Obligations	1,700

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Ocean, Coastal, and Great Lakes Research

	Object Class	2006 Increase
11	Personnel compensation	
11.1	Full-time permanent	258
11.9	Total personnel compensation	258
12	Civilian personnel benefits	66
25.2	Other services	173
41	Grants, subsidies and contributions	3,627
99	Total Obligations	4,124

Department of Commerce
National Oceanic and Atmospheric Administration
Operations Research and Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Oceanic and Atmospheric Research
Subactivity: Information Technology, R&D, & Science Education

	Object Class	2006 Increase
25.2	Other services	226
99	Total Obligations	226

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